MANORAMA

Tell Me Why

No: 71

KNOWLEDGE MAGAZINE FOR CHILDREN

THE STORY OF PETROLEUM

100 + FACTS ABOUT THE FUEL THAT POWERS THE WORLD

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SHOUT
SHARE
IT

ALONE WITH HITLER !
A poster that appeared in US, during World War II. It promotes sharing of cars to save petrol. What the poster says is that to travel alone in a car is as bad as travelling with Hitler.

MANORAMA
Tell Me Why
From the house of MAGIC POT, MANORAMA YEAR BOOK, VANITHA, THE WEEK & THE MALAYALA MANORAMA DAILY

August 2012
Volume: 6
No: 11

A King who's a Liquid!

Oil rules our world. The world's economy virtually revolves around petroleum. The word 'petroleum' is coined from two Latin words - 'petra' and 'oleum'. Petra means rock, and oleum means oil, and these words, in brief, tell their story very well. Petroleum is formed from the remains of ancient living things.

Man has been using oil for thousands of years. But we began to consume oil in vast quantities only in recent times. Oil has now become one of our planet's most valuable commodities, essential to our daily life. This means that very large quantities of oil are being dug out, and the world's oil supplies are gradually running out.

A real, viable alternative for oil is yet to be discovered. This issue of Tell Me Why tells you the fascinating story of the world's most valuable natural resource – one that rules the modern world, and literally, makes it go!

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THE STORY OF PETROLEUM

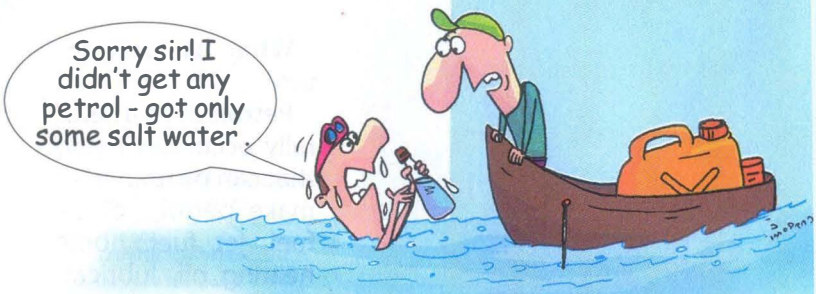
Crude Oil

Did you know that one barrel, or 159 litres of the unprocessed liquid oil that is known as crude oil, has enough energy to boil about 2700 litres of water?

An Offshore Oil Platform

What is petroleum?

Petroleum is a naturally occurring liquid that can be refined to make petrol, diesel fuel, jet fuel, home heating oil, lubricating oil, wax, asphalt, and many other valuable products. It is usually a dark and oily liquid, but it can also be in a solid or gaseous form. When petroleum comes straight out of the ground as a liquid, it is called a crude oil, if it is dark and sticky. If it is clear and volatile, it is called a condensate. Petroleum that is solid is called asphalt, while in the semi solid state it is known as bitumen. In the gaseous state, petroleum is natural gas. Petroleum is a complex mixture of chemicals, and is an entirely natural product made out of the decomposed remains of living things.



Where did the word petroleum come from?

Petroleum is one of the world's most important substances, for it is a rich source of valuable chemicals. The word 'petroleum' comes from the Latin 'petra' which means 'rock' and 'oleum' which means 'oil'. So, the word actually means 'rock oil'.The rocks in which petroleum is found lie deep underground. The 'crude', as people in the oil industry call petroleum, is reached by drilling beneath the Earth's surface. Petroleum is called by many names, including 'black gold' and 'liquid sunlight.' It is called 'black gold' because crude oil is usually black in colour, and at the same time, it is valuable like gold. Sometimes it is called 'liquid sunshine', because the sun is the Earth's main source of energy, and petroleum is made from decomposed plants that stored the sun's energy millions of years ago.

Crude oil provides the basic raw material for the polycarbonate plastic which is used for making laptop cases. It also provides the energy to make the internal parts of a computer, and generates the electricity to charge its batteries.

How did petroleum form?

Petroleum is formed by hydrocarbons. A hydrocarbon is a compound made up of carbon and hydrogen, with the addition of certain other substances, primarily, sulphur.

Petroleum is actually the remains of animals and plants that lived millions of years ago, even before the dinosaurs, in a marine environment.

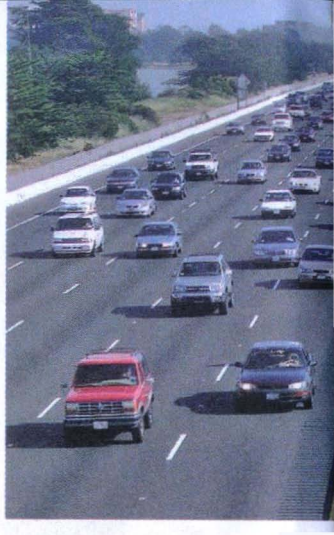
In those times, the Earth was very different from what it is now, and most of the areas that are now land, were then under water. Marine plants and animals stored the sun's energy in their bodies. When they died, their remains sank to the bottom of the oceans and seas, and were covered by tiny particles of rock and soil.

As the remains of these animals and plants settled under layers of sand and mud, chemicals and bacteria went to work. Over long periods of time, tiny oil droplets were formed.

In time, tiny droplets of oil seeped into the layers of porous rocks, and were held in place in the same way that a sponge holds water.

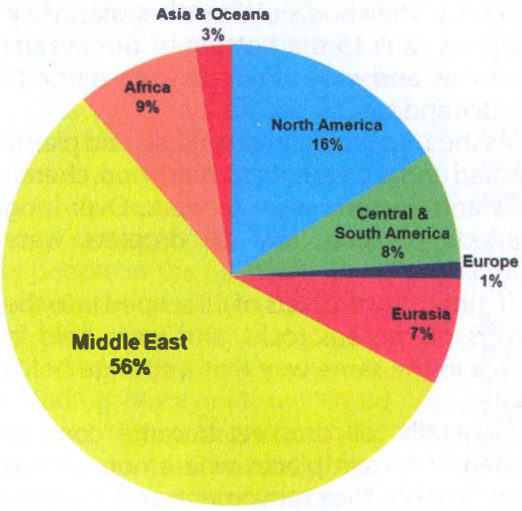
Generally, oil droplets became concentrated in certain places where non porous rock blocked their movement, and it is from these areas that we get crude oil, which is petroleum in its natural, liquid form.

A Drill at work for a New Oil - Well



Star Fact — Freedom and Crude oil

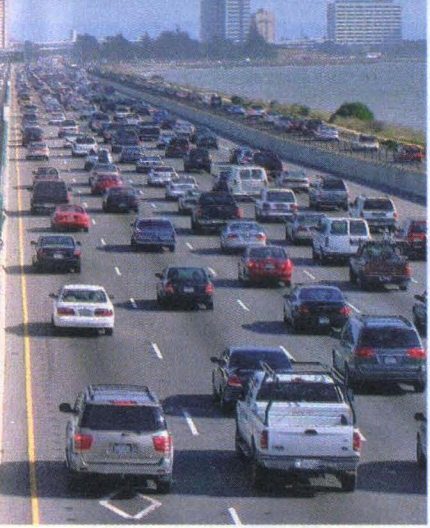
Crude oil gives us petrol which runs our cars, buses, and other forms of transport-and in effect, gives us the freedom to travel. There are over 60 million motor vehicles on the world's roads, and this figure is rising daily. About a billion barrels of oil are burned each month to run these vehicles.



World Oil Reserves by Region

Why is petroleum sometimes found far inland?

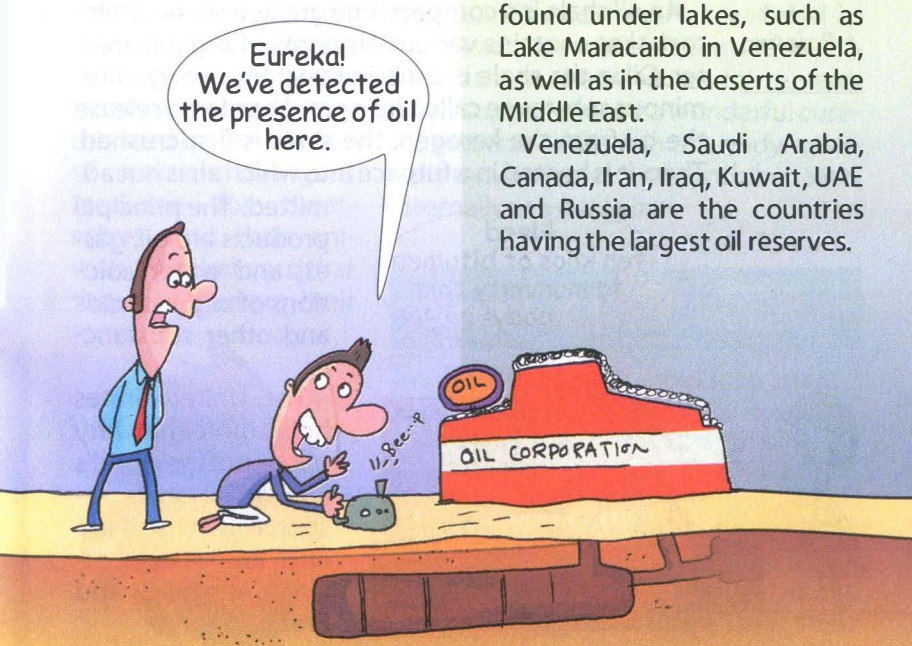
We know that the Earth's crust has shifted a lot over millions of years. These great movements of the Earth's crust pushed the bed of the ocean down in some places, and raised it in others. Where the ocean bed was raised, mountains were formed. In time, these mountains were worn down. Continents also changed their shape, and the oil bearing rocks that were once at the bottom of the ocean, were pushed this way and that. They were shifted to different places further inland, away from the shore, and that is why we find oil in deserts today.



Where are the main oil deposits in the world found?

Oil is found in the shallow gently sloping ocean bed that lies between the shoreline and the ocean depths. This slope is known as the continental shelf, and most continents are bordered by such a shelf. The deposits found here are known as offshore deposits. Offshore deposits are found in Bombay High, the Gulf of Mexico, the Persian Gulf, and the North Sea, and off the west coast of the United States. Oil is also found under lakes, such as Lake Maracaibo in Venezuela, as well as in the deserts of the Middle East.

Venezuela, Saudi Arabia, Canada, Iran, Iraq, Kuwait, UAE and Russia are the countries having the largest oil reserves.



Noah's Ark - A Painting

What are oil shales?

An oil shale is a compact, fine grained sedimentary rock that contains various amounts of organic matter. Oil in the shale is contained within a waxy, bituminous substance called kerogen. In order to release the oil from the kerogen, the shale is first crushed. Then, it is heated in a furnace into which air is not admitted. The principal products are oil, gases, and water solutions of organic acids and other substances.

The United States holds more than fifty percent of the world's known oil shale resource. Oil shales are also found in Scotland, Australia, and Brazil.

What were the uses of petroleum in ancient times?

People have known about petroleum from ancient times. They collected it when it bubbled to the surface in the form of pitch or tar, or seeped into wells. Petroleum was used by different civilizations in many ways. It is believed that Noah used pitch to make his ark seaworthy when the Great Flood threatened to destroy mankind. The Egyptians coated mummies, and sealed their mighty pyramids with pitch. The Babylonians, Assyrians, and Persians used it to pave their streets, and hold their walls and buildings together. Boats along the Euphrates were constructed with woven reeds and sealed with pitch. The Chinese used petroleum for heating.

How do we know that the American Indians used petroleum?

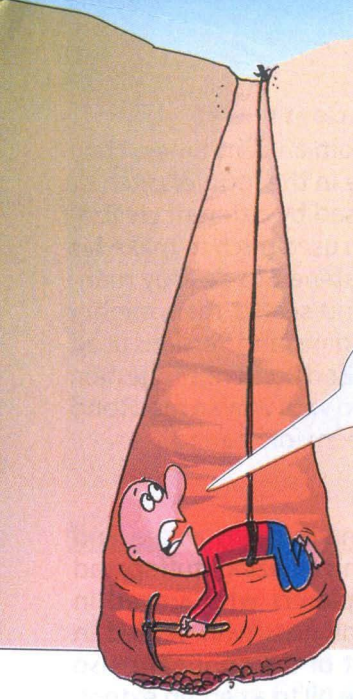
American Indians employed the black liquid that oozed from beneath rocks and accumulated on the surface of creeks and springs as medicine for themselves, and their animals. They believed that this oil toned up their muscles, and made them active and quick. Word of this amazing stuff spread to the early explorers who arrived in America. The colonists who settled in the eastern part of the continent also began to use the oil to a certain extent. It was supposed to be a wonderful cure-all, and was rubbed on the body externally to cure rheumatism, and also taken internally as a medicine.

Star Fact — Petrol Medicine!

Desert nomads used it to treat camels for mange, and the Roman Emperor, Charles V, used petroleum to treat his gout. The Ancient Persians and Sumatrans also believed petroleum had medicinal value. Even in the 19th century, jars of petroleum were sold as a miracle tonic for all illnesses!

Where were the first oil wells located?

The Chinese have used oil and gas for many centuries. They were drilling down into the Earth to get natural gas, and brine before 400 BC. The Chinese used bamboo pipelines to carry natural gas and mixed it with air to yield a usable source of fuel for fires.



In 1806, men boring wells in Western Virginia to get brine, found that the brine or salt water, had oil in it. However, they had no idea what the oil was, or how useful it would prove to be. In fact, they were rather annoyed because the oil made the brine wells useless.

The first oil well was drilled in Asia, on the Aspheron Peninsula north-east of Baku, by a Russian engineer F.N. Semyenov in 1848. Edwin Drake is often credited with drilling a modern oil well in Pennsylvania in 1859, starting a boom in the modern petrochemical and mining industries. However, we must remember that people had been drilling oil wells in China for over two thousand years before him.

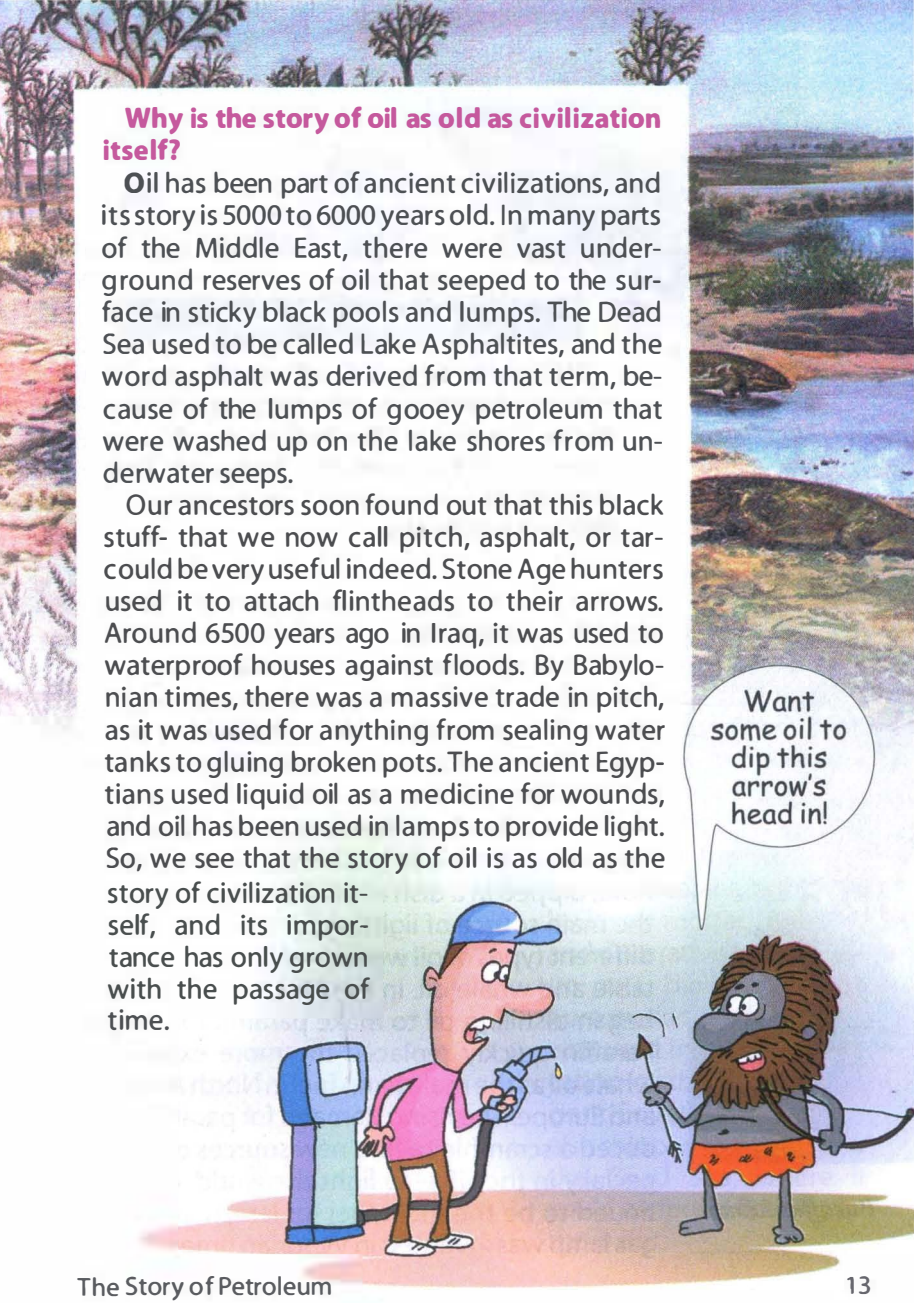
Oil on the Move

Huge quantities of oil are on the move every day to meet our needs. It is transported in supertankers across oceans, pumped through long pipelines, and driven by road tankers to different destinations.

Why is the story of oil as old as civilization itself?

Oil has been part of ancient civilizations, and its story is 5000 to 6000 years old. In many parts of the Middle East, there were vast underground reserves of oil that seeped to the surface in sticky black pools and lumps. The Dead Sea used to be called Lake Asphaltites, and the word asphalt was derived from that term, because of the lumps of gooey petroleum that were washed up on the lake shores from underwater seeps.

Our ancestors soon found out that this black stuff- that we now call pitch, asphalt, or tar- could be very useful indeed. Stone Age hunters used it to attach flintheads to their arrows. Around 6500 years ago in Iraq, it was used to waterproof houses against floods. By Babylonian times, there was a massive trade in pitch, as it was used for anything from sealing water tanks to gluing broken pots. The ancient Egyptians used liquid oil as a medicine for wounds, and oil has been used in lamps to provide light. So, we see that the story of oil is as old as the story of civilization itself, and its importance has only grown with the passage of time.



Curious Fact

Oil and Air Travel

Millions of people fly all over the world to enjoy holidays in different parts of the globe. The planes that fly them need huge amounts of fuel, and this fuel is oil. The amount of oil consumed by air travel is rising dramatically.

Paraffin Lamp

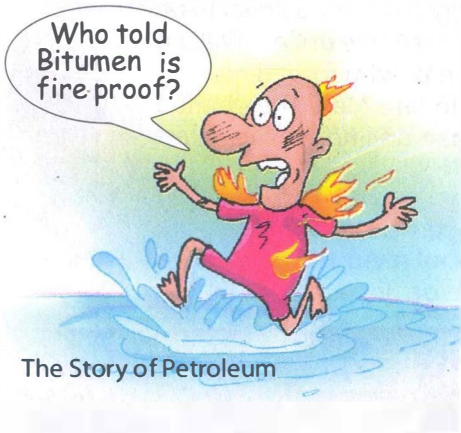
Why has oil played an important role in lighting the world?

Thousands of years ago, Early Man discovered that oils burn with a bright, steady flame. The first oil lamps were made by hollowing out a stone, filling it with moss or plant fibre soaked in oil, and then setting the moss alight. Later, it was found that the lamp would burn longer and brighter, if there was just a wick made of some fibre, dipped in a dish of oil. Oil lamps remained the main source of lighting for centuries. Many different types of oil were used, including vegetable and whale oil. In the Middle East, people began distilling oil to make paraffin for lamps. Paraffin quickly replaced the more expensive whale oil as the main lamp fuel in North America and Europe. The rising demand for paraffin produced a scramble to find new sources of oil-especially in the USA- to light the world. Oil continued to be the main fuel for lamps, until the gas lamp was invented in Victorian times.

What were the different uses of bitumen in the past?

Bitumen, a black sticky liquid, is very inflammable, but its strong adhesive properties have made it a very useful product since ancient times. It was used to make roofs and buildings waterproof in ancient cities like Carthage. In fact, when the Romans set Carthage on fire in 146 BC, it was the bitumen in the buildings that helped the fire to spread rapidly, and destroy Carthage completely.

In the 6th century BC, Persian archers put a thinner form of bitumen on their arrows to fire flaming missiles at their enemies. In the 6th century AD, the Byzantine navy used deadly firebombs made from bitumen mixed with sulphur and quicklime to destroy their enemies. In short, bitumen was used extensively, both during peace and war by civilizations of the past.



Natural Bitumen

Why are Egyptian mummies associated with bitumen?

Bitumen is a black, oily, viscous material that is a form of petroleum. Also known as asphalt or tar, bitumen was mixed with other materials throughout prehistory, and throughout the world for use as a sealant, adhesive, building mortar, incense, and decorative application on pots, buildings, or on human skin. Bitumen was also used in the mummification of the dead in Ancient Egypt. Bitumen was also shipped to Egypt from the Dead Sea, where it could be found floating on the water.

The Petroleum Industry

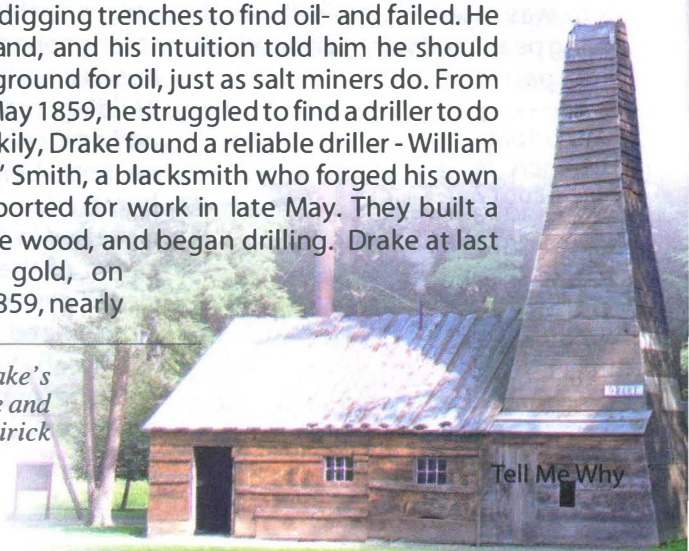
The history of the modern petroleum industry begins in the 19th century.

Distillation of kerosene from petroleum was invented by James Young in Scotland in the 1840's. Where was the first commercial oil well? This is a difficult one to answer. Edwin Drake's 1859 well near Titusville, Pennsylvania, is popularly considered the first modern well. Drake's well is probably singled out, because it was drilled, not dug, and because it sparked off a major boom. However, there was considerable activity before Drake in various parts of the world in the mid 19th century. A group of mining engineers hand-drilled a well

Why is Edwin Drake famous in the history of petroleum?

The petroleum industry began when Edwin L. Drake drilled a successful oil well at Titusville, Pennsylvania in 1859. It was drilled with the sole purpose of finding oil, and was known as 'The Drake Well' after the man responsible for it.

Drake tried digging trenches to find oil- and failed. He studied the land, and his intuition told him he should drill into the ground for oil, just as salt miners do. From July 1858 to May 1859, he struggled to find a driller to do the work. Luckily, Drake found a reliable driller - William A. 'Uncle Billy' Smith, a blacksmith who forged his own tools, and reported for work in late May. They built a derrick of pine wood, and began drilling. Drake at last struck black gold, on August 28th 1859, nearly



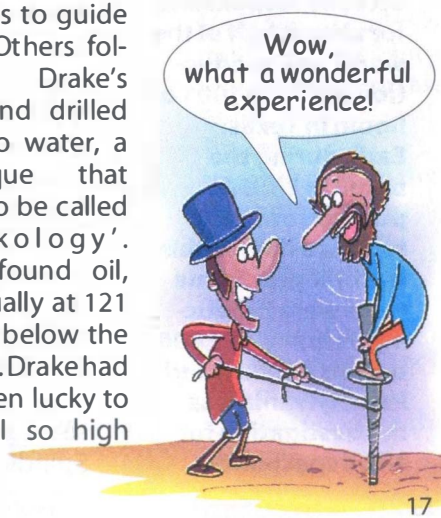
Replica of Drake's Engine house and Deririck

in the Baku region of Azerbaijan, in 1848. There were engine-drilled wells in West Virginia in the same year as Drake's well. A nearly commercial well was hand-dug in Poland in 1853, and another in nearby Romania in 1857.

At around the same time, the world's first, but small, oil refineries were opened at Jaslo, in Poland. Romania is the first country in the world to have its crude oil output officially recorded in international statistics, namely 275 tonnes. By the end of the 19th century, the Russian Empire, particularly the Branobel company in Azerbaijan, had taken the lead in oil production.

Edwin Drake

twenty-one metres down. His discovery started Pennsylvania's oil rush. Drake's well produced only thirty-five barrels of oil a day. However, he could sell it for $20 a barrel. News of the well quickly spread, and brought droves of fortune seekers. Soon, the hills were covered with prospectors trying to decide where to dig their wells. Some used Y-shaped divining rods to guide them. Others followed Drake's lead, and drilled close to water, a technique that came to be called 'creekology'. Many found oil, but usually at 121 metres below the surface. Drake had just been lucky to find oil so high up!



Spindletop Field- Flag Marks the Luca's Well

Why is it said that the modern oil industry was born on a hill in South Texas?

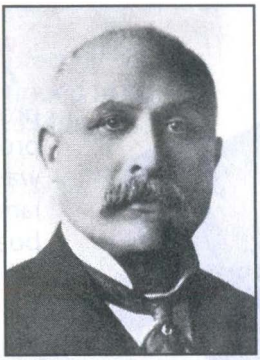
Spindletop Hill in South Texas is a mound created by an underground salt deposit. On January 10th, 1901, an enormous geyser of oil exploded from a drilling site at Spindletop Hill. Soon, Spindletop was producing more than twice the amount of oil than all the wells of Pennsylvania combined. The gusher from the well reached a height of more than 45 metres, and produced close to 100,000 barrels a day. It was more powerful than any previously seen in the world. From January 10th, 1901, through September 30th, 2000, Spindletop produced 155,700,000 barrels of oil. A booming oil industry soon grew up around the oil field at Spindletop.

Star fact

Big Pennsylvania

Pennsylvania was actually responsible for almost half of the world's oil production until the 1901 oil boom in Texas. Early during the boom in 1859, it pumped out 25 barrels a day. Within the first year, some wells were producing as many as 3,000 barrels per day, and Pennsylvania was the destination for all oil speculators.

Luca's Gusher at Spindletop



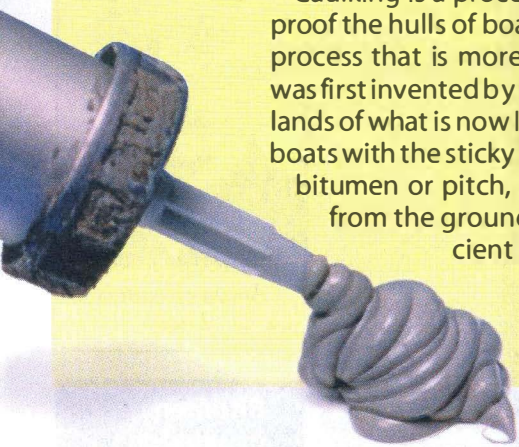
Antony Francis Luca

Bitumen in Babylon

Most of the buildings in Ancient Babylon were built by using bitumen. King Nebuchadnezzar used it for everything, from mortars to bricks. Bitumen was lavishly used in the famous Hanging Gardens. It was used as a waterproof lining for the plant beds, and also for the pipes that carried water to the plants.

What is caulking?

Caulking is a process that was used to waterproof the hulls of boats until recent times. It is a process that is more than 6000 years old, and was first invented by people living in the marshy lands of what is now Iraq. They coated their reed boats with the sticky black stuff that we now call bitumen or pitch, which they found oozing from the ground. They found it a very efficient method of preventing

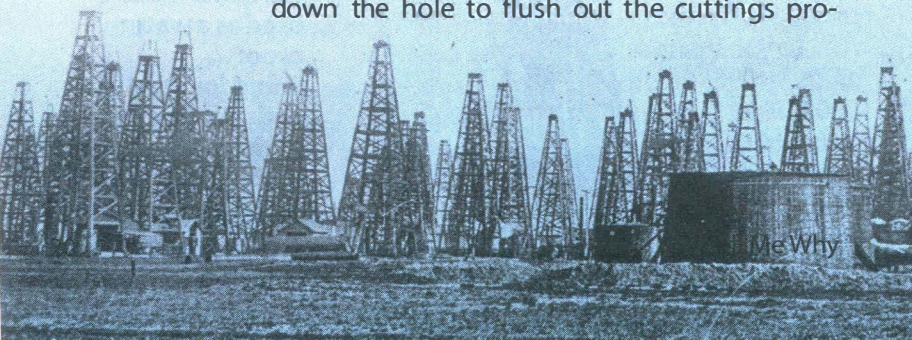


Caulking

Why is the story of drilling in South Texas an interesting one?

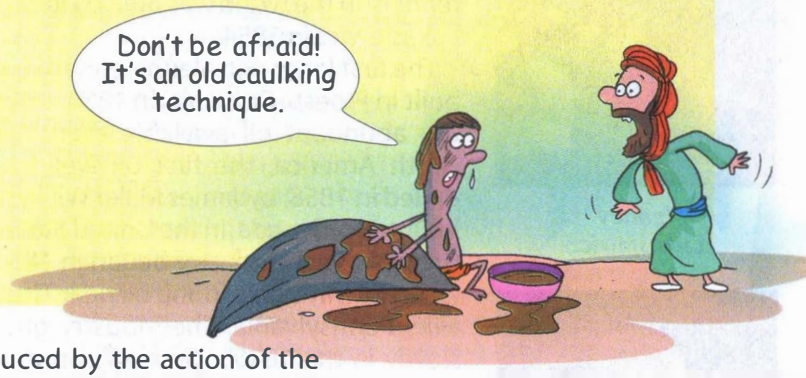
Drilling for oil was a difficult task in South Texas, as there is little rock to drill through. Instead speculators searching for oil, called wildcatters had to drill through hundreds of feet of sand. This was very dangerous, as the hole created when the sand was drilled sometimes caved in suddenly. It was Antony Lucas, who struck oil at Spindletop Hill, who solved the problem. One of his drillers, Curt Hamhill, had a revolutionary idea. Instead of pumping water down the hole to flush out the cuttings pro-

Oil Wells at Spindletop (1902)

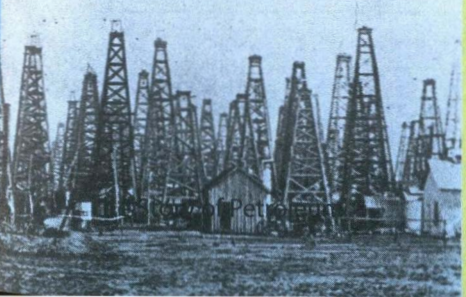


Me Why

leaks in their boats. The idea was later adopted by the builders of wooden boats too. Caulking continued to be in use in boat building until modern metal and fibre glass hulls became common.



duced by the action of the drill, he used mud. This not only helped in retrieving the cuttings, but just as importantly, it was found that the mud stuck to the sides of the hole, and kept it from caving in. Mud has been used in almost every drill hole around the world ever since then. In drilling, the word mud means, drilling fluid and not ordinary mud!

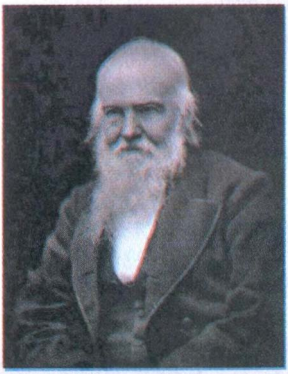


Star fact

A Warm Welcome!

In the Middle Ages, burning oil was poured over enemies who tried to scale the walls of towns. The method was first used by the Jews, who were defending the city of Jotapata against the Romans in 67 AD. However, it was a costly way to defend a town, since oil was extremely expensive.

Ignacy Lukasiewicz



James Young

Why is the story of the early refineries an interesting one?

It was James Young of Scotland who invented a process to distill kerosene from petroleum in the 1840's. The first refinery in the world was built by Ignacy Lukasiewicz in 1854.

The first large petroleum refinery was built in Ploesti, Romania, in 1856, using the abundant oil available there. In North America, the first oil well was drilled in 1858, by James Miller Williams in Ontario, Canada. In the United States, the petroleum industry began in 1859, when Edwin Drake found oil near Titusville, Pennsylvania. The industry grew slowly in the 1800's, primarily producing kerosene for oil lamps.

In modern times, the refinery in Ras Tanura, Saudi Arabia, owned by Saudi Aramco, claimed to be the largest oil refinery in the world. For most of the 20th century, the largest refinery was the Abadan Refinery in Iran. This refinery suffered extensive damage during the Iran-Iraq War. The world's largest refinery complex now is the Jamnagar Refinery Complex, consisting of two refineries side by side, operated by Reliance Industries in Jamnagar, India.

Ras Tanura

Lamps and Posters

Curious Fact

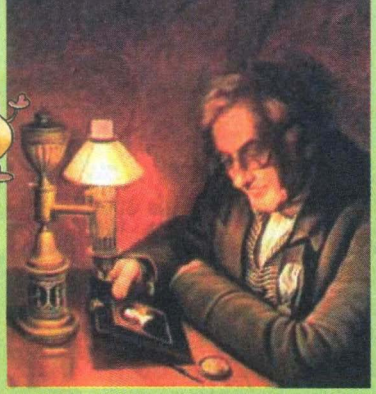
Paraffin became very popular as a fuel for lamps by the 1890's. Paraffin companies advertised their product through posters that claimed it to be clean, odourless, and safe. The French company Saxoleine had posters showing women going into raptures over lamps filled with their oil. The posters were done by famous artist, Jules Cheret.

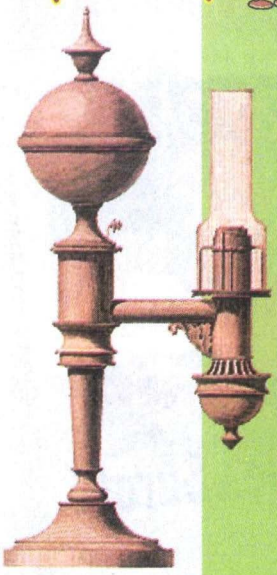
Jules Cheret

'Sweet' Oil and Sour Oil

Crude oil comes in a wide range of colours- black, green, red, and brown. Crude oil from Sudan is jet black, while that from the North Sea is dark brown. Oil from Texas in the US is the

Star fact



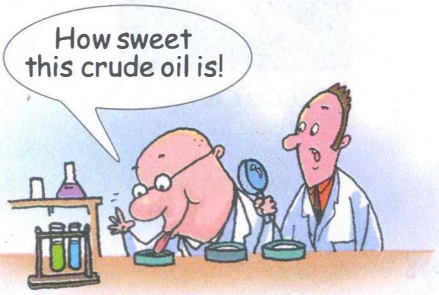


Argand's Lamp

Argand's Lamp

Aime Argand, a Swiss physicist, invented a lamp in the 1780's, that was a great breakthrough. He placed a circular wick in the middle of an oil lamp, and covered it with a chimney to improve the air flow. This lamp burned more brightly and cleanly than the other lamps of the time, and quickly replaced all the other types of lamps that were being used.

colour of straw, while oil from Utah, which is also in the US, is amber. Some oils are called 'sweet' because they contain less sulphur, and are easy to refine. Others are termed 'sour', because they contain more sulphur, and need more processing. There are light oils that are thin and volatile, and heavy oils that are thick and sticky. There is no doubt though, that in whatever form it comes, crude oil is one of the most useful products known to Man.



Curious Fact

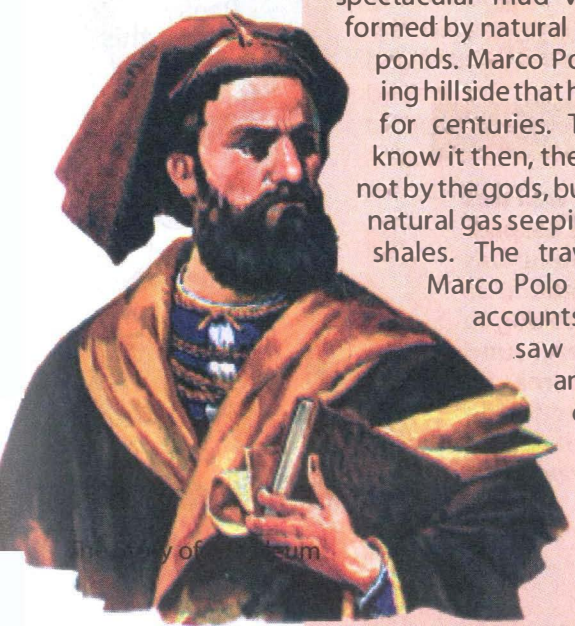
Packed Energy

Long, long ago, tiny organisms used the energy from sunlight to manufacture food through a process known as photosynthesis. These organisms were eventually converted into oil as they lay buried under sediment, and decayed through the centuries. This oil is packed with a highly concentrated form of the energy that was trapped in the organisms.

Why is Marco Polo's travelogue considered useful for information about oil?

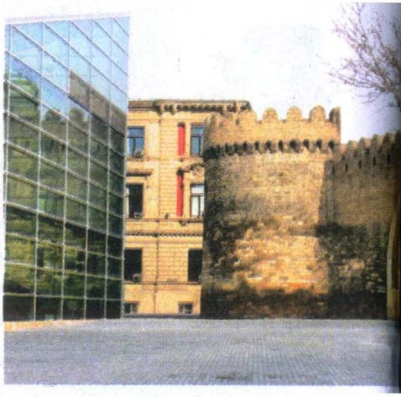
Marco Polo, a 13th century traveller, visited the Persian city of Baku in 1264. To his amazement, he saw an oil seep which he described as a fountain from which oil flowed in great abundance. He also saw spectacular mud volcanoes that were formed by natural gas seeping through ponds. Marco Polo described a flaming hillside that had been worshipped for centuries. Though he did not know it then, the flames were caused not by the gods, but by condensate and natural gas seeping through fractured shales. The travelogue written by Marco Polo contains many vivid accounts of the sights that he saw around Azerbaijan and Baku - and these descriptions tell us a lot about the early history of oil in that region.

Marco Polo



Why is the early history of oil in Poland and Romania an interesting one?

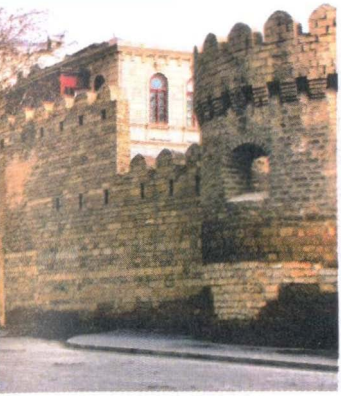
As early as the 16th century, oil that was seeping out of the ground, used to be scooped up in buckets from pits in the Carpathian Mountains that run through Romania and Poland. In the town of Krosno, it was used to light street lamps, even though it gave off a foul smell, and lots of smoke and soot. It was Ignacy Lukasiewicz who experimented with the distillation techniques that were perfected earlier by Dr. Abraham Gesner in Canada, to produce clear kerosene from the smelly seep oil. To provide oil for his kerosene business, Lukasiewicz initially collected thick, sticky crude from shallow, hand-dug wells.



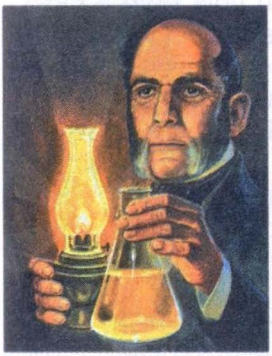
Curious Fact

The Black City

The world's first oil well was drilled at Baku on the Caspian Sea in 1847. Soon Baku was the centre of an oil boom, as hundreds of wells were dug to tap the vast underground sources of oil in the area. By 1860, Baku was producing 90% of the world's oil at that time, and it became known as the Black City.



Walled City of Baku



Abraham Gesner

Later, he teamed up with Titus Trzecieski and Mikolaj Klobassa to establish an 'oil mine' which pumped crude oil from hand-drilled, 30 to 50 metre deep wells. Other entrepreneurs dug their own wells, and a thriving Polish oil industry soon developed. Some of these early wells were dug by hand, while others were drilled with spring poles. These springy wooden poles were stuck in the ground at an angle, and a heavy metal drill bit was attached by a cable to the head of the pole. Operators would bounce up and down on stirrups attached to the pole, causing the bit to drill a hole into the ground, until oil was struck!

Town of Krosno

Star Fact

Steam Engines in Pennsylvania

During the Civil War in the United States, steam engines were used to drill oil wells mechanically in the Pennsylvania oil fields. Later, Thomas Bard brought a steam-powered drilling rig and crew from Pennsylvania, and drilled an oil well in California in 1865.

What is a gusher?

Gushers, also known as spouters, fountains, and blow outs, are oil wells that rage out of control. A gusher sends a column of oil shooting skywards. The Baku region of Azerbaijan was especially known for gushers. In fact, the practice of letting wells flow unchecked was encouraged, as it was realized that when the flow of a gusher was restrained, production went up in competing wells. To put it in a nutshell, when flow from a gusher dropped, the competitor got more oil! However, several gushers brought ruin to their owners when they flooded the countryside in oil, and buried it in sand. The owners of the well were responsible for the resulting property damage. Baku, Pennsylvania, Poland, Texas, and California all have had gushers. All of them have claimed the title of having the world's greatest gusher at one time or the other.

Curious Fact

Oil by the Bucket

The first oil well in America was discovered by James William in 1858. He thought that the oily black swamps of Lambton County in Ontario, Canada, might be an important source of petroleum from which paraffin to light lamps could be made. So, he dug a hole, and the oil was so plentiful that he could scoop it up in buckets as it bubbled up. The area soon became famous as Oil Springs.

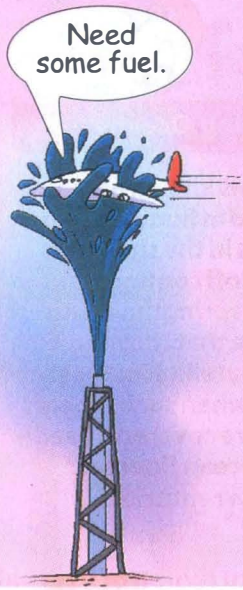
Oil Gusher, Baku (1856)

Blooming Oceans

Tiny organisms known as planktons are found in huge masses called blooms in the shallow ocean waters off continents. They erupt in springtime, and are so massive that they can be seen even in satellite images. Oil is formed when such blooms of plankton are covered by sediment on the ocean floor and decay over the centuries.

Why is the Baku region of Azerbaijan special?

The Baku region of Azerbaijan is famous for its gushers or spouters. The first big Baku spouter was drilled on the Balakhani plateau in 1873, when the Vermishev spouter of the the Khalifi Company raged out of control for four months. A huge cone of mud and sand formed around the well and rivers of oil flowed out across the entire field. In fact, even after two years, the stalk of this spouter was still twelve metres tall, and two and a half metres in diameter! Other famous spouters of this region were the Kormilitza spouter, and the Soutchastniki spouter in 1875, and the Orbelovi brothers' spouter in 1877, at Shaitan Bazaar.



Which is the most famous spouter in Baku?

The most famous of the Baku spouters was drilled by the Droozhba Company, a small Armenian outfit that picked up a lease on the Balakhani plateau. Their well, which became known as the Droojba fountain, was drilled to a depth of 175 metres when it blew out on September 1st, 1883 at a rate of 40,000 to 50,000 barrels of oil per day. The fountain spouted oil 60 to 90 metres into the air, and raged out of control until it was capped on December 29th, having produced an estimated 220,000 to 500,000 tonnes of oil!

An even bigger spouter was drilled by the Tagiev brothers near Bibi-Eibat. The well was started in 1884, and its yield was modest at

Nodding Donkey

Oil used to be pumped up by using a driving beam that swung slowly up and down. As the head of the beam fell, the pump's plunger would descend down into the well. As the head rose, the plunger would come up, drawing oil to the surface. These pumps were called 'nodding donkeys', because of this up and down action.

Curious Fact

Nodding Donkey

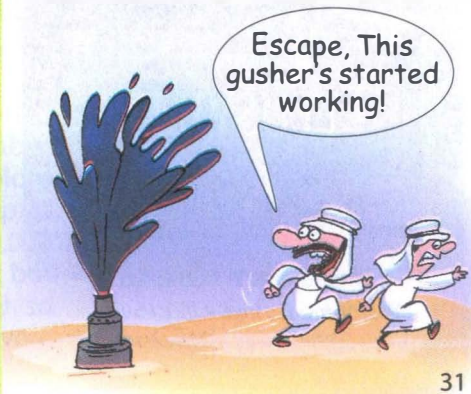
first. However, when it deepened to 217 metres on September 27th 1886, it struck new oil sand and spouted a column of oil 68 metres high. The maximum flow was reached on the 8th day, when it produced more than the combined flow of all 25,000 wells in America, and the thousands of wells in Romania. After the 10th day, however, the flow began to diminish, and by the 15th day, it steadied.

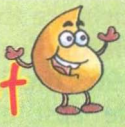
Oil in Space

Astronomers have detected the presence of benzene, which has the classic ring-shaped hydrocarbon molecule, in outer space. Such ring shaped molecules are usually found in oil, which seems to suggest that oil exists in outer space too.

Which are the main gushers in the Middle East?

In 1908, the first big gusher in the Middle East erupted during the drilling of an oil well in the Masjede-Soleiman field in Persia. The column of oil soared 15 metres above the drilling rig. The well was drilled by William Knox D'Arcy, who later organized his holdings into the Anglo-Persian Oil Company, which became the Anglo-Iranian Oil Company, a predecessor of British Petroleum. Another big gusher was the discovery well of the Baba Gurgur field near Kirkuk, Iraq, in 1927. This field was famous for Eternal Fire - a gas seep that has burned for at least 4,000 years. The discovery well was drilled by the Turkish Petroleum Company. The gusher began spraying the countryside with oil, and a river of oil was formed! It took eight and a half days to bring the well under control.





Halfway Stage

Buried marine organisms first turn into kerogen, which is a brown- black solid found in sedimentary rocks. Kerogen represents only the first stage of the transformation of marine organisms into oil. If kerogen is heated under pressure to more than sixty degree centigrade, oil can be extracted from it.

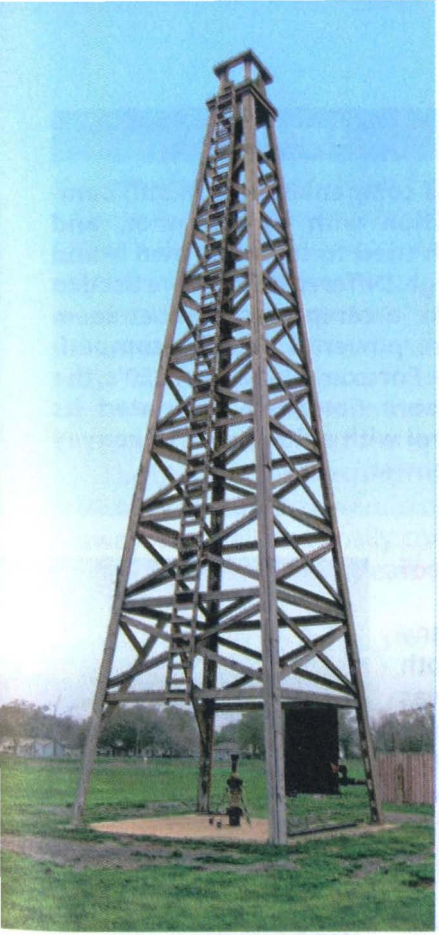
Which are the main gushers of Pennsylvania?

During the Pennsylvania oil boom, several gushers were drilled. In May 1861, Capt. A.B. Funk drilled one nicknamed the 'Fountain'. On October 20th 1861, Thomas and William Phillips were drilling their second well on Oil Creek, when a gusher erupted with a flow of 4,000 barrels a day. The oil flowed unchecked for three or four days, and the well continued to produce record amounts of oil for over twenty years. Some of the most spectacular gushers were located at Thorn Creek, in the Appalachian Mountains. The first big well was drilled in 1884 by the Phillips Brothers on the Bartlett farm. Other gushers were drilled by Hezekiah Christie whose gusher produced 7,000 barrels a day for several days, and, Colonel S.P. Armstrong, whose well spewed 8,000 barrels on the first day itself.

Welcome Board - Titusville

Why does Texas play an important role in the history of oil?

Spindletop, one of the greatest gushers of all time, ushered in an oil boom in Texas. Anthony Lucas, a Louisiana mining engineer, was drilling a



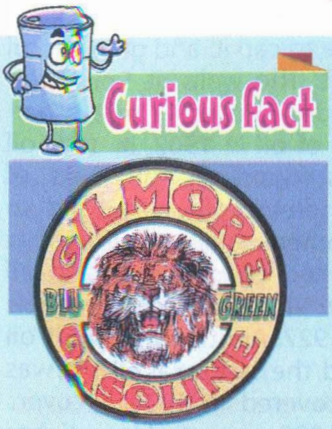
Replica of Luca's Gusher

well at Spindletop Hill, when the ground began to tremble, and a great spout of oil exploded into the air. The well produced an astounding 800,000 barrels of oil in just 8 days, but quickly dropped off enough so that Lucas and his crew were able to cap it, and gain control of it. The wells at Spindletop produced over 17 million barrels of oil in 1902. In 1925, oil was found on the flanks of Spindletop Hill, which led to another surge in drilling that pushed production to an all time high of 27 million barrels in 1927. Another important oil field, the East Texas oil field, was discovered in 1930. It covers 140,000 acres today, and has 30,340 historic and active oil wells. It is the second largest oil field in the United States outside of Alaska.

Curious Fact

Fire

Fire was the greatest danger at oil drills. Refineries blew up, well heads burst into flames, and oil tanks caught fire frequently. Once a fire started, it was difficult to extinguish, because it was being constantly fed by the oil below the surface.



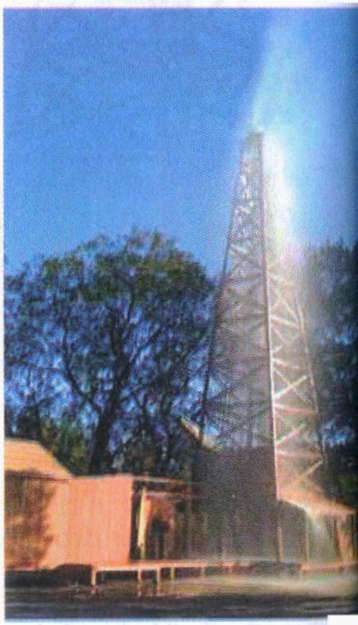
Lion for Oil!

Oil companies were in stiff competition with one another, and each tried to create its own brand image. Different ideas were used to make a company's product seem more powerful than its competitors. For example, in the 1920's, the Gilmore Company associated its petrol with a lion's roar to convey its power.

Which are the famous gushers of Oklahoma?

In 1897, the Cudahy Oil Company drilled a well In Oklahoma to a depth of 402 metres. The well, which was named the Nellie Johnstone No. 1 spouted oil over the top and the Oklahoma oil boom was on. The Nellie Johnstone produced more than 100,000 barrels before being plugged and abandoned in 1948. Another famous Oklahoma gusher was the Wild Mary Sudik. It received national attention when it was drilled in 1930. At its peak time it produced 72,000 barrels of oil a day. The Wild Mary Sudik was finally capped on April 6.

In 1981, another gusher erupted in Oklahoma. It was the Amarex Pennington-Thompson well. The rig caught fire two days later, and collapsed.



Replica of Nellie Johnstone's Oil Well

Why is a gusher in the Gulf of Mexico famous?

The Gulf of Mexico is famous for a gusher that set fire to a drilling rig - 'Deep Water Horizon', on April 20th 2010. The drill was owned by Transocean Ltd, and leased out to British Petroleum. Eleven men were killed in the fire, while another 115 were evacuated, 17 of them with injuries.

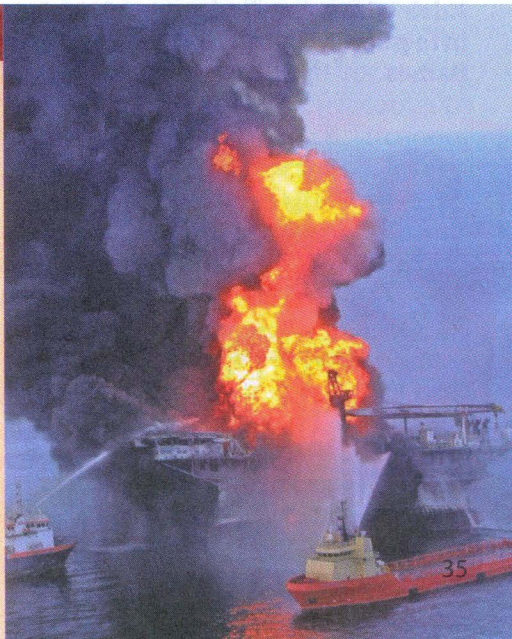
The disaster occurred on a type of rig known as a semi submersible drilling rig. It is a floating rig that does not use anchors. Instead, a computer system keeps the rig at all times within a few metres of its intended target. The rig is capable of working in water depths up to 3048 metres.

The blowout resulted in an explosion with flames 60 to 90 metres high that were visible as far as 56 kilometres away. The well was finally controlled on July 15th, 2010, and officially declared 'dead' on June 19th.

'Deep Water Horizon' in Flames after the Explosion

Rock Bends

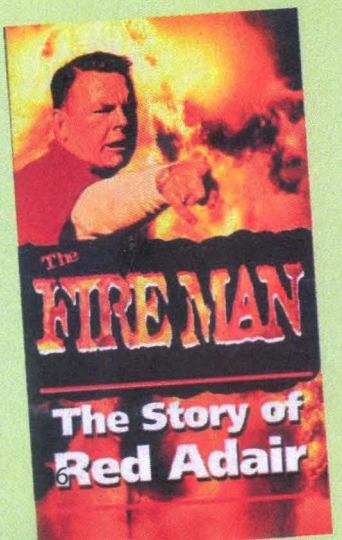
The Earth's crust is made up of huge rock plates that are constantly moving. This movement creates intense pressure, which is so great that layers of solid rock can be bent. Sedimentary rock from the ocean bed is often crumpled to form arches called anticline arches, where oil is trapped.



Curious Fact

Red Adair

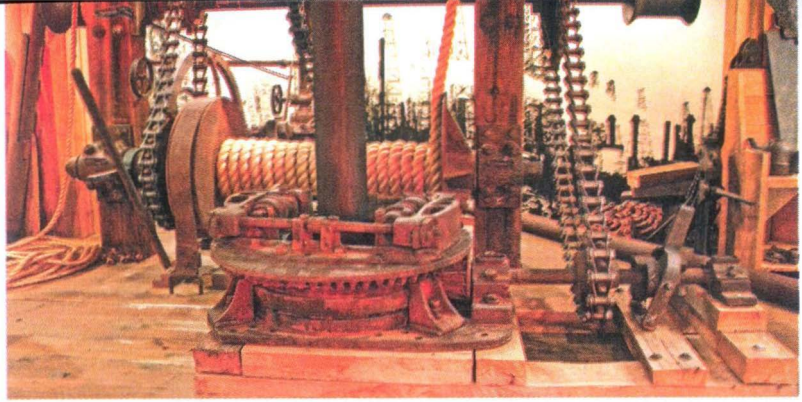
Red Adair is famous as an expert in fighting oil well fires. He gained his international reputation in 1962, when he tackled a fire at a gas field in the Sahara. When the oil wells in Kuwait caught fire during the Gulf War of 1991, it was 77 year old Red Adair who was called in to put out the flames.



What do you know about gushers in Latin America?

One of the famous gushers of Latin America was the Cerro Azul No. 4 - a gusher that blew out on February 10th, 1916, near Tampico in the state of Veracruz, Mexico. When the Cerro Azul No. 4 well blew, the oil spouted nearly 182 metres into the air. On February 19th, the well was capped, and brought under control.

Another famous gusher was the Barroso No. 2 well in Cabimas, Venezuela. It blew out at a depth of 457 metres on December 14, 1922. The blow created a column of oil 61 metres high. The well gushed for nine days, covering the countryside with nearly a million barrels of before oil, before it was capped.



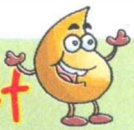
Some of the Drilling Equipments of Luca's Oil Well, Displayed at Texas Energy Museum

What are oil traps?

Oil traps are places where oil collects underground after seeping up through the surrounding rocks. This slow seepage begins soon after liquid oil first forms in a 'source' rock. Over a period of time, oil and gas are squeezed out of the source rock, like water from a sponge. The oil seeps up through rocks that have tiny cracks. When it comes to a rock through which it cannot pass, it becomes trapped. The oil then accumulates to form a reservoir of oil that is known as an oil trap.

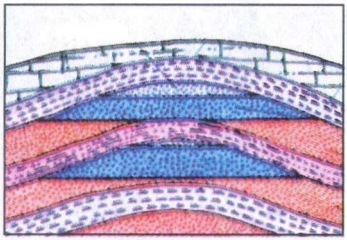
Reservoir Rocks

Star Fact



Rocks where oil accumulates are called reservoir rocks. Most reservoir rocks have fairly large grains that are loosely packed, so that the oil can seep up. Sandstone, limestone and dolomite are some examples of reservoir rocks.

Which are the different types of oil traps?

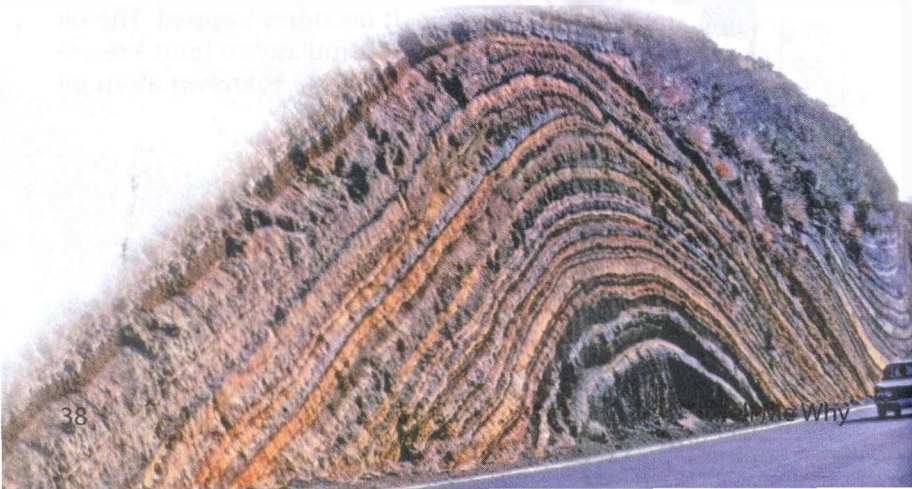


Anticline oil Trap

Oil is often trapped in arches that are formed when layers of rock have been bent into an arch by the movement of the Earth's crust. There are four major kinds of oil traps. If the bent layer does not allow the oil to ooze through, the oil accumulates there and forms an Anticline trap. Another type of trap is the Fault trap, which is formed when oil accumulates along a layer of non permeable rock that has slid over a layer of permeable rock along a fault in the Earth's crust.

The Salt Dome trap is formed when masses of salt that lie deep underground are pushed upwards by intense heat and pressure to form domes. The salt cuts across layers of permeable rock, blocking the path of oil that is seeping upwards, and creating an oil trap. The Pinch-out traps are formed by variations in the rock layers themselves. Basically, they occur where sand, which is permeable, gets trapped in layers of impermeable rock, such as shale and siltstone.

A Rock Containing Anticline Trap



Magnetic Search

Magnetic searches for oil depend on an aircraft that is equipped with a device called the magnetometer. This device detects variations in ground magnetism. Sedimentary rock, where oil is likely to be found, is generally much less magnetic than volcanic rock that is rich in magnetic metals like iron and nickel.

How is oil found?

Initially, oil and natural gas exploration was as simple as locating surface seeps or places where oil and gas had been discovered accidentally, while digging or drilling for water. Today, oil prospectors use their knowledge of geology to look for oil traps where oil can be found. They know that oil is likely to be found in the basins of sedimentary rock. There are around 600 such basins around the world. These basins are closely examined for exposed rock outcrops with likely looking formations.

Satellite and radar images are also studied for this purpose. Once an area has been selected, geophysical surveys are carried out. In short, geologists and geophysicists use their skills to identify underground structures which appear to have good potential for oil production.

A Semi-submersible Oil Platform

Star Fact

Smith's Layers

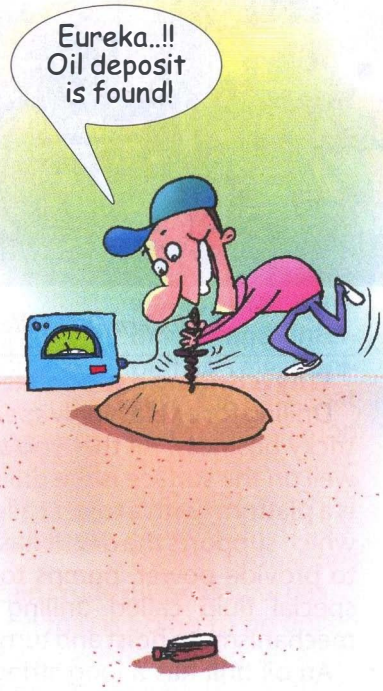
It was William Smith, an English canal engineer, who made the first geological maps that traced rock layers right across a landscape. He could identify rock layers by the unique fossils they held. Each type of animal, he realized, had a widespread existence for a particular span of times. This made it possible for Smith to recognize the order in which rocks had been formed throughout much of England.

How is oil extracted from oil sands?

Oil sands are naturally occurring mixtures of sand, clay, and water which are saturated with a dense and extremely thick form of petroleum called bitumen. If the sands are near the surface, oil can be mined by digging a huge pit. The sand that is dug, is broken up and mixed with hot water to form slurry. The slurry is sent to a separation plant, where the oil is then removed from the sand, and sent to a refinery for processing. If the sands containing oil are buried deep in the Earth, steam is injected. The steam melts the bitumen, which is then separated from the sand. The bitumen is pumped to the surface, and sent for processing at a refinery. In another method, oxygen is pumped in, and a fire started. The fire melts the oil, which is then pumped up.

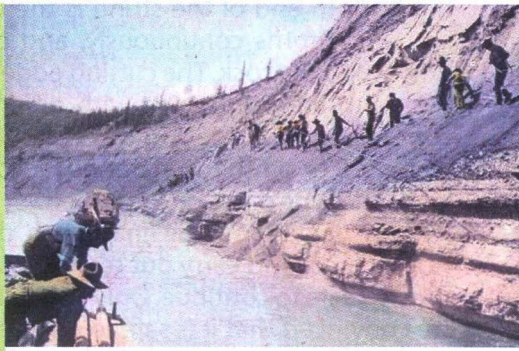
How is oil drilled?

Drilling is the only way to locate and extract oil from an oil field that lies underground. Test drilling is usually carried out in likely locations first. However, before this is done, companies must make sure that they have the legal right to drill. Drilling is done to the region just above where the oil is located. A casing of concrete is then inserted into the newly drilled hole to make it stronger. Next, little holes are made in the casing near the bottom to let oil in. The well is topped with a special assembly of control-and safety-valves called a 'Christmas tree'. Finally, acid or pressurized sand is sent down to break through the last layer of rock, and start the oil flowing into the well.



Athabasca Oil Sands

The world's largest deposits of oil sands are found in Alberta, Canada, and in Venezuala. The deposit at Athabasca in Alberta is the only one that is near enough the surface to be dug out economically.



Athabasca Oil Sands

A Modern Oil Driller

Why is drilling a specialized process ?

Drilling for oil is a highly specialized and tricky business. All that you see of an oil well on the surface is the drilling rig. This is a platform with a tower called a derrick, which supports the drill. It has generators to provide power, pumps to circulate a special fluid called drilling mud, and mechanisms to hoist and turn the drill.

An oil drill has a long string of drilling rods made from hundreds of pieces. At the bottom end of the string is the drill bit, which turns continuously, and cuts slowly into the rock. The cutting edges of the teeth are toughened with different combinations of steel, tungsten-carbide, diamond, or synthetic diamond, according to the type of rock to be drilled.

As the drillers near the final depth, they stop drilling, and carry out tests to make sure it is safe to continue. Only when they are convinced that it is safe to go ahead, do they proceed to the final depth from where oil is extracted.

Waterproof Roads

Over 2500 years ago, bitumen was used in Ancient Babylon to make smooth, waterproof roads. In the 19th century, road builders began making roads with gravel that was bound together with hot tar, or bitumen. The process was devised by a Scottish Engineer called John Loudon McAdam.

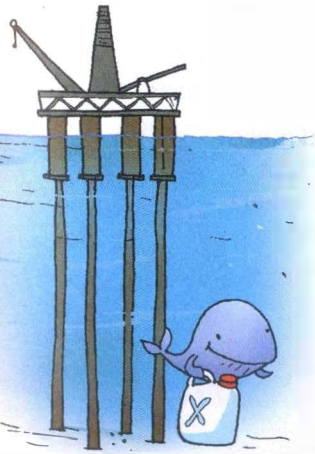
John Loudon McAdam

Why are off shore rigs special?

Oil is sometimes found deep beneath the ocean bed. It is located by seismic surveys. Boats tow cables attached to sound detectors called hydrophones to detect reflected sound waves. These sound waves are combined, and interpreted electronically for data that gives information on the depth, position, and shape of underground geological formations that may contain crude oil, or natural gas.

An Offshore Rig

Since the land that is going to be drilled cannot provide a base for drilling, an artificial platform must be created. This platform is known as an offshore rig. Offshore rigs are huge structures that have legs that stretch hundreds of metres from the surface of the ocean to the ocean floor. The rigs have to be extremely strong in order to face pounding seas and gale force winds. There are two basic types of offshore drilling rigs- those that can be moved from place to place, allowing for drilling in multiple locations, and those rigs that are permanently placed. The Petronius Platform in the Gulf of Mexico is the world's tallest structure. It stands some 610 metres above the sea bed.



Star Fact

Terrorist Threat

Oil is a vital part of our lives today, and this makes oil pipelines a target for terrorists. Pipelines are constantly guarded against this threat. Sometimes though, the pipelines run for vast distances, and it is not possible to guard their entire length.

An Oil Refinery

What are the steps in offshore drilling?

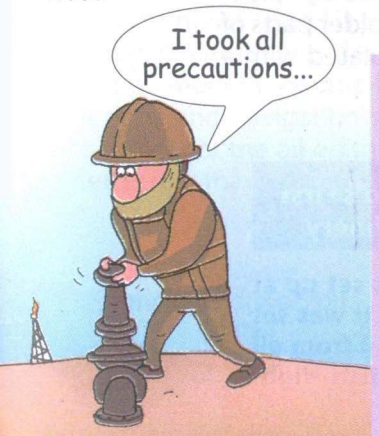
The platform of an offshore rig lies above the surface of the ocean floor. Scores of people work on it throughout the day and night. They maintain the rig, and operate the drills. Many wells are drilled beneath an offshore rig. Up to 30 drill strings branch off in different directions, sometimes for several kilometres, before they bore into the ocean floor. Each string has a drill bit with three whirring cone shaped wheels at its tip, which grinds into the rock on the sea floor. Every rig has a team of highly skilled divers permanently on call. The divers maintain the underwater structure, pipes, and cables, and make repairs where necessary. When oil is struck, it is pumped to the shore through pipelines. Tankers then carry the oil to the refinery for processing.

An Oil Tanker at Guanabara Bay

Why is life on the oil rigs dangerous?

Working on an oil rig is a dangerous occupation. To begin with, there is always the risk of a blow out that can wreck the rig, and kill those working on it. If the blow out ignites, it burns furiously, and the fire is difficult to extinguish. Leaking gas can also cause fatal explosions. Living in the middle of the ocean is also hazardous, for one is at the mercy of rough seas, tornadoes, hurricanes, and storms. The workers have to stay on the rig for weeks at a time. While they are on the rig, they have to take stringent safety precautions. Everyone is required to wear earplugs virtually everywhere on the platform. Hard hats, eye protection, and steel-toed boots are also mandatory. Today, rigs have separate floating hotels to house the workers. This offers them protection during off duty hours at least.

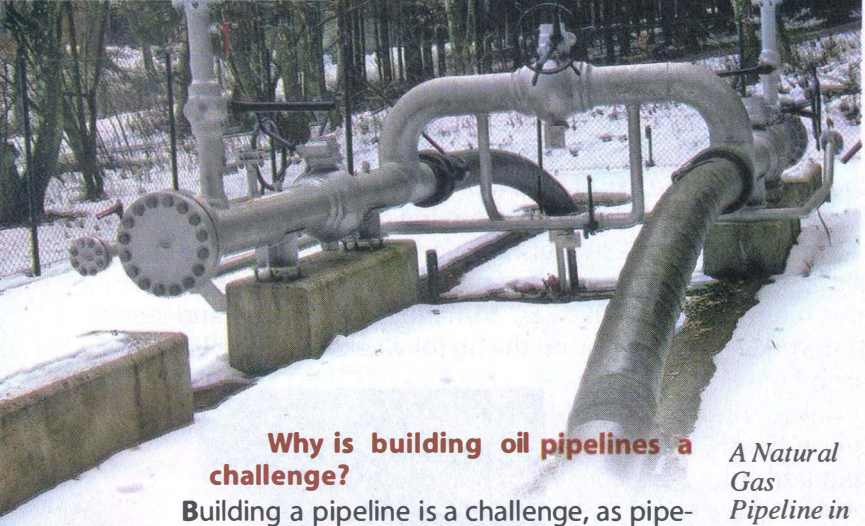
An Oil Rig Explosion



Curious Fact

Quake Risk

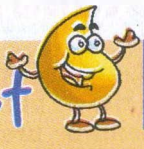
Earthquakes pose a great danger to the oil pipelines. The pipe can bend or break as has happened in Parkfield, California, during an earthquake. So scientists are constantly monitoring the ground for tremors along the routes taken by oil pipelines.



A Natural Gas Pipeline in Switzerland

Why is building oil pipelines a challenge?

Building a pipeline is a challenge, as pipelines have to cross very difficult terrain, and have to be maintained under harsh climatic conditions. The largest pipelines are the 'trunk' pipelines that take crude oil from drilling regions to refineries or ports. These trunk lines are fed by smaller 'gathering' lines that carry oil from individual wells. Every pipeline carries mobile plugs for checking problems, and are called 'pigs'. Robot 'pigs' are used today for maintenance work. If oil gets too cold, it becomes thicker, and more difficult to pump through pipelines. Because of this, many pipes in colder parts of the world and under the sea are insulated with a special substance called 'aerogel'.



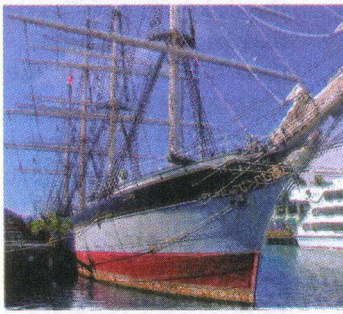
World's First Refinery

The world's first oil refinery was set up at Bathgate near Edinburgh in 1851. It was set up by James Young. He distilled oil from oil shale that was found in the Scottish Highlands.

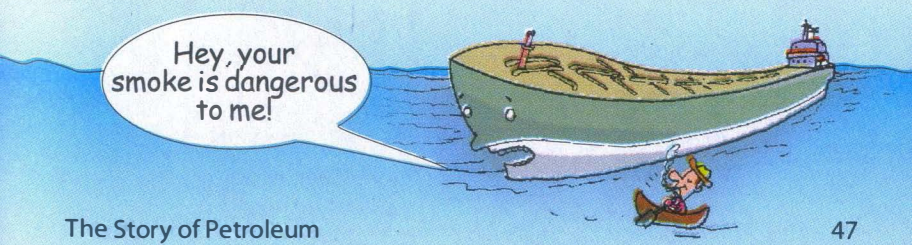
Supertanker AbQaiq

Why do tankers play an important role in oil distribution?

It is estimated that around 3500 tankers ply the oceans daily, transporting oil to wherever it is needed. The tankers transport mainly crude oil. The largest tankers are known as supertankers. They weigh over 300,000 tonnes when they are empty, and can carry millions of barrels of oil, worth hundreds of millions of dollars. What is amazing is that, they are so automated that they only need a crew of about 30 to run them. Supertankers are so immense that they easily dwarf the largest ocean liners. Some are even longer than the Empire State Building laid on its side! Once the tanker docks at an oil terminal, the oil is pumped out by a pump called the deep well cargo pump. Modern double-hulled tanker designs and navigation systems mean that most of the oil on the move is carried across the ocean safely.



'The Falls of Clyde'- The Oldest Surviving American Tanker



Politics and Pipelines

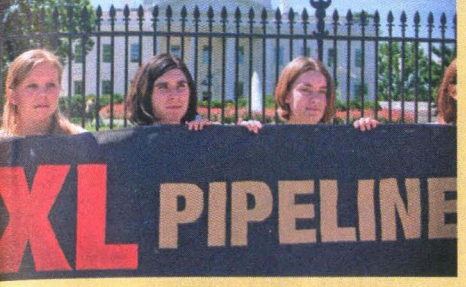
European nations backed the building of the Baku-Tbilisi-Ceyhan, pipeline, which runs 1,776 km from the Caspian Sea in Azerbaijan to the Mediterranean coast of Turkey via Georgia. They did this so that they would not be completely dependent on Russia and Iran for oil.

How is oil refined?

Crude oil is processed at an oil refinery and separated into different components. An oil refinery is a huge complex of tanks and pipes. The process of refining is done in many steps. There is fractional distillation which separates the oil into fractions like light and heavy oil. In the next stage called cracking, the fractions are split further into different products.

The pipe still is the heart of the refinery. The temperature in a pipe still is carefully controlled, so that it decreases with height and each tray is slightly cooler than the one below. Pipes exit the still at different levels to take away the different fractions as they condense or settle on the trays. Today, over half the crude oil brought to a refinery is made into petrol. Finally, an almost pure-carbon residue called coke is left. This coke is sold as solid fuel.

An Oil Refinery



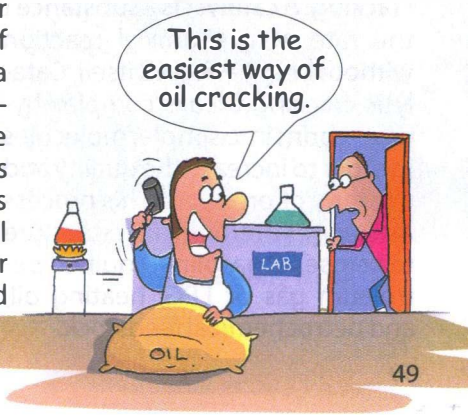
Star Fact

Pipelines and People

In many countries, poor people live near the pipelines. This is very dangerous, as a leak in the pipeline can cause a fatal explosion. Once a pipeline is operational, it represents money and power to those who own the oil, but is an ominous threat to the poor who live alongside it.

What is cracking?

Crude oil is broken down in oil refineries into its component parts, known as fractions, and these can then be used for many different purposes. Fractions that are produced by the distillation of crude oil can go through a process called cracking. We know that crude oil is made up of molecules of hydrocarbons. Fractions containing large hydrocarbon molecules are vaporised, and passed over a hot catalyst. This breaks chemical bonds in the molecules, and forms smaller hydrocarbon molecules. To sum up, cracking is a process in which heavy-molecular weight hydrocarbons are broken up into light hydrocarbon molecules by the application of heat and pressure, with or without the use of catalysts, to derive a variety of fuel products. Cracking is one of the principal ways in which crude oil is converted into useful fuels such as motor gasoline, jet fuel, and home heating oil.



Oil Refinery in Israel

What are the different methods of cracking?

There are several different methods of cracking. Thermal cracking is a refining process in which heat and pressure are used to break down, rearrange, or combine hydrocarbon molecules. Steam cracking is a petrochemical process sometimes used in refineries to produce raw materials like ethylene from various feedstock for petrochemicals manufacture. Steam cracking is carried out at temperatures of 800-900°C, and at pressures slightly above atmospheric.

The most common form of cracking is catalytic cracking. A catalyst is a substance that can change the rate of a chemical reaction without being affected itself. Catalytic cracking breaks complex hydrocarbons into simpler molecules in order to increase the quality and quantity of products. This process rearranges the molecular structure to kerosene, gasoline, liquified petroleum gas or LPG, heating oil, and petrochemical feedstock.

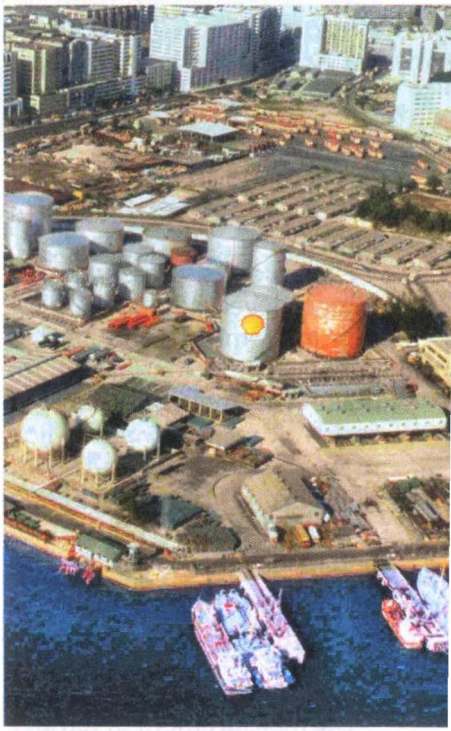
First Afloat

In 1861, the American sailing ship Elizabeth Watts carried 240 kegs of oil from Philadelphia to England. The oil was transported in wooden barrels, and the ship itself was made of wood. This was very dangerous, as both the oil and the ship could easily catch fire. In 1884, the British built the first modern tanker- a steel hulled steam ship, which held the oil in a steel hold.

What is an oil depot?

An oil depot is a facility used to store oil and petrochemical products. It is usually situated near refineries or places where marine tankers can discharge their cargo. Some depots are attached to pipelines. No processing is done at an oil depot- it is used only for storage.

The oil is stored in the oil depot until it is transported to another storage facility, or to the end users, who are the people who actually use the product. The depot will have tanks that are used for storage. These tanks can be either underground, or above the ground. An oil depot will also have gantries which have loading arms through which the products are dispersed into vehicles that will transport them to another destination.



Oil Depot in Hong Kong

Oil Terminal

Star Fact

There are only a limited number of sites that are suitable for oil terminals because supertankers carrying oil need water that is at least 20 metres deep. The supertankers have to sometimes moor at piers that stretch far out into the water, and the crews have to drive to and from the ship.

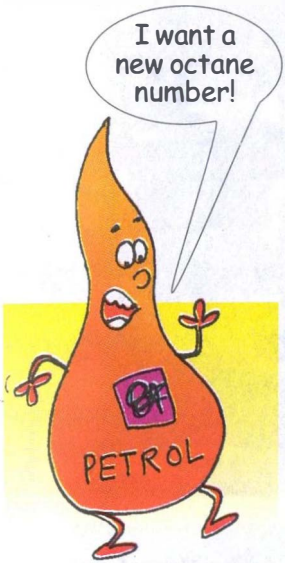
Bacton Gas Terminal-UK

Which are the main instruments used in petrochemical industries?

Flow meters, pressure transmitters, level meters, temperature instruments, and analysis instruments are some of the main instruments used in petrochemical industries. A flow meter is an instrument used to measure the flow rate of a liquid or a gas. Refined oil is measured before leaving the refinery, because it is important to make it clear how much oil is transported at each measurement site along the pipeline.

The measurement of temperature is a vital part of instrumentation in petrochemical industries. Platinum resistance temperature detectors are often used, as they are very efficient. Pressure to current converters are used to measure and show the amount of pressure developed by the liquified petroleum gas, crude oil, petrol, and various other petroleum byprod-

A Magnetic Flow Meter



ucts. Level meters are important, because petroleum, natural gas, and petrochemical industries place high requirements on level measurement.

One of the most reliable methods for measuring level is the nuclear gauge. Industrial chromatographs make up a large proportion of analysis instruments. Continuous gas analyzers are also widely applied to the petrochemical industry.

What is octane rating?

Octane rating tells you how much a fuel can be compressed before it spontaneously ignites. It is used to measure the performance of motor or aviation fuel. Octanes are a family of hydrocarbon that have the typical components of petrol. They are colourless liquids that boil around 125°C. The higher the octane number, the more compression the fuel can withstand before detonating. Fuels with a higher octane rating are used in high-compression engines that generally have higher performance. In contrast, fuels with low octane numbers are ideal for diesel engines. Petrol with a low octane number may lead to the problem of engine knocking, which can cause severe engine damage.

Curious Fact

Cetane Number

The Cetane number is a measurement of the combustion quality of diesel fuel during compression ignition. It is a significant expression of the quality of a diesel fuel. In a particular diesel engine, higher cetane fuels will have shorter ignition delay periods than lower cetane fuels.

Global Fuel

Why is petrol the most important derivative of petroleum?

Thousands of products are derived from crude petroleum, but the most common of these products are kerosene, diesel, and petrol. Kerosene is a light and volatile liquid fuel derived from petroleum. Kerosene was formerly used chiefly to provide light. It now serves mainly as a fuel for cooking, and for operating space-heating installations and farm equipment. It is also used in the fuel mixture for jet planes.

Diesel fuels are also greatly in demand in recent years. Diesel engines are to be found in ships, railway locomotives, buses, trucks, automobiles, and installation for generating electricity.

Forty-five per cent of the total yield of crude petroleum goes into the production of petrol. Vehicles on roads consume about nine tenths of all the petrol that is produced, while the rest is used by airplanes, tractors, and various types of equipment. So, there is no doubt that it is petrol that is the most important derivative of petroleum.

Which are the main derivatives of petroleum besides petrol?

Some of the main derivatives of petroleum besides petrol are light and residual fuel oils, lubricants and greases, wax, asphalt and carbon black, as well as LPG and petrochemicals. Light fuel oils are used in automatic house heating burners, and in small commercial heating units. Residual fuel oils are heavy fractions of crude petroleum, and are the cheapest of fuel oils. Lubricants and greases are important, as they are needed for machinery that needs oiling. Wax is used for packaging, waterproofing, and the preparation of moulds and casting.

Asphalt is used mainly for roofing and road surfacing, while carbon black is used in the production of automobile tyres and other rubber products. LPG is used for cooking. Petrochemicals are the chemicals, derived from crude petroleum and natural gas, which play an important role in our daily life.

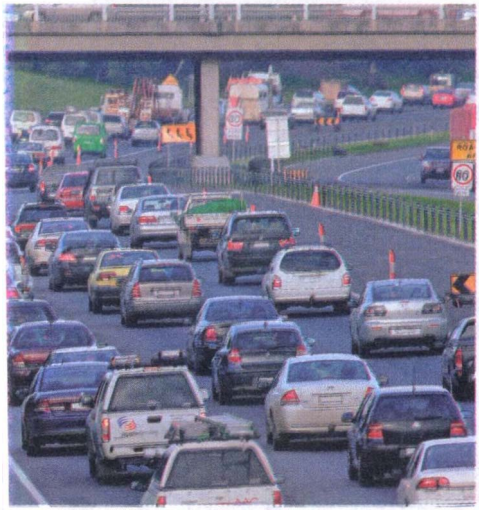
Star Fact

Exxon Valdez

The oil spill from the tanker Exxon Valdez on March 24th, 1989 was one of the worst environmental disasters ever. Over 42 million litres of oil were spilt when the tanker hit a reef, killing over 250,000 seabirds, 2,800 sea otters, 300 seals, and many animals.

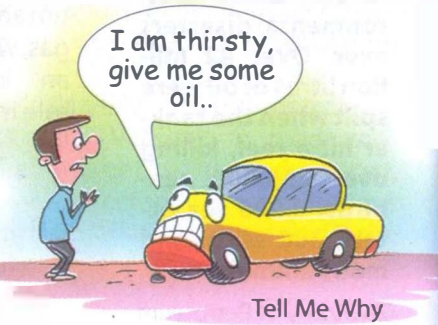
Splitting by Fractions

In fractional distillation, crude oil is heated until it turns to vapour. The vapour then goes into a tall tower known as the pipe still. The pipe still is divided at intervals by horizontal trays. The heaviest fractions cool, turn into liquid, and settle at the bottom trays. The lighter fractions drift upwards, and condense on the upper trays. The lightest fractions, including petrol condenses on the topmost trays.



Why is oil essential for our well being?

Oil is an essential part of our daily life. Over 80% of all the oil produced is used for energy, and most of it is burnt in engines in the form of petrol, diesel, maritime fuel oil, and aviation fuel for transport. It takes more than thirty million barrels of oil each day to keep all our vehicles on the move! Oil is used for cooking, and to produce the electricity that is vital to keep the world running smoothly today. The use of natural gas power stations is on the rise, as they are very efficient and eco-friendly. Did you know that oil plays a part in growing our food? Fertilizer is used for crops, and fertilizers rely on petroleum. That is why food prices rise when the price of oil goes up!



WATCH FOR THESE MARKS THEY MEAN SYNTHETIC RUBBER
HOW TO INSTALL SYNTHETIC TIRES
HOW TO MAINTAIN SYNTHETIC TIRES
HOW TO DRIVE ON SYNTHETIC TIRES

A Poster about Synthetic Rubber

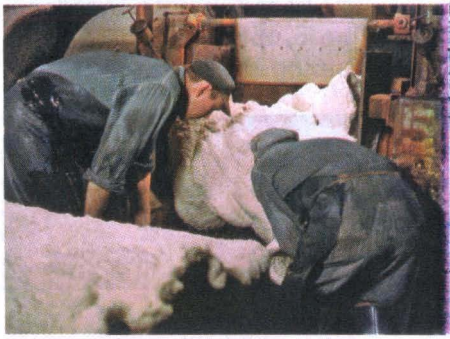
Curious Fact

Oil in Store

Oil is stored in a refinery in gianttanks. The volume of the oil is measured in barrels. One barrel is equal to 159 litres. A typical refinery can hold about 12 million barrels of oil in its tanks.

What are the different things we can get from oil?

Oil is a rich mix of hydrocarbons that can be processed to give us very useful substances known as petrochemicals. Petrochemicals are used to make an amazing range of materials and products, especially synthetic substitutes for natural products like synthetic rubber, and paraffin wax to make candles. Plastics are made from petrochemicals too, and they are used for everything in the house from kitchen containers to the TV remote controls. Plastics can be heated and moulded into almost any shape, because they are made from incredibly long molecules called polymers. Scientists use the hydrocarbons in oil to create a variety of polymers not only for plastics, but also to make synthetic fibres. Did you know that nylon is made entirely from petrochemicals derived from petroleum?

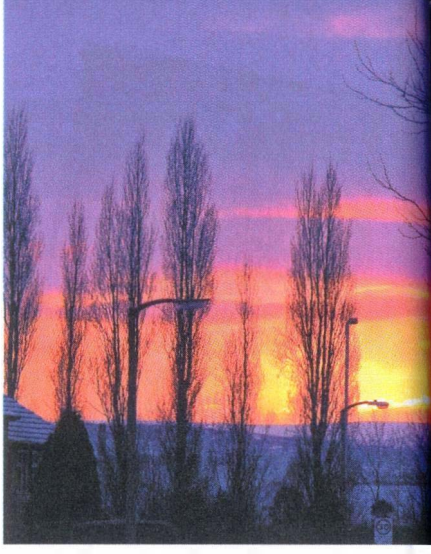


Sheets of Synthetic Rubber

Curious Fact

Secondary Petroleum Products

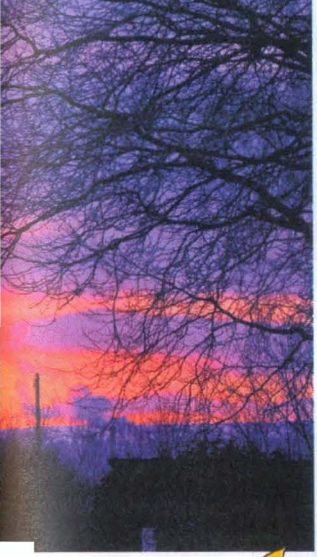
Secondary petroleum products are products that are derived from petroleum, and their number is increasing day by day. Some examples are synthetic detergents, synthetic textiles, 'squeeze bottles', adhesives, plastic-based paints, garden hose, upholstery, luggage, piping and plastics.



Factory Smoke at Sunset

Why does oil usage cause global warming?

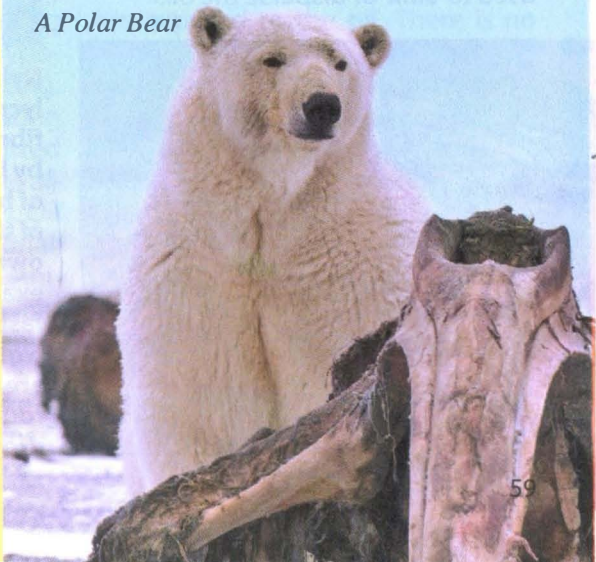
It is now known that the burning of oil plays a big part in global warming. How does this happen? Certain gases in the atmosphere, such as carbon dioxide, water vapour, and methane, act like the glass in a greenhouse. They trap the sun's infrared radiation, which keeps the Earth warm enough to sustain life. However, when oil is burnt in huge quantities, it releases so much carbon dioxide into the atmosphere. As a result, the Earth is becoming warmer, and this phenomenon is known as global warming. And one of the main culprits of this is oil!



What are the other problems caused by the increasing use of oil?

The increased use of oil results in global warming, and this causes melting of the polar ice caps. Wildlife in the region, including polar bears, face the danger of becoming extinct. As the ice melts, sea levels will rise. The burning of oil pollutes the air with unburned hydrocarbons. These hydrocarbons react with sunlight to form a toxic fog in large cities. Unburned compounds form soot in the air, and this is responsible for a variety of diseases, including cancer. Petrochemical plants also emit polluting gases and particles into the air, besides clouds of steam. Forests are fast disappearing as companies search for oil in tropical rain forests. The destruction of rainforests will have disastrous consequences for more than half the world's plant and animal species.

A Polar Bear



Star Fact

Looking Good

Many beauty products like lipstick, eyeliner, mascara, and hair dye are made from petrochemicals. Petroleum jelly is used in most skin lotions. It is a waxy, paraffin like material, made from petroleum. Baby oil and baby cream are very often, petroleum based too.

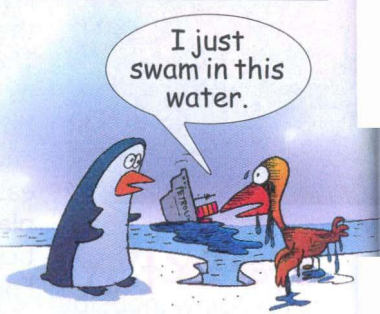
What are oil spills?

An oil spill is a form of pollution that occurs when a liquid petroleum hydrocarbon is accidentally released into the environment because of human activity. Oil spills may occur on land or in the ocean, but they usually happen in the ocean. A ship carrying crude oil may be caught in a storm, or strike a reef, tearing open its oil tanks.

Oil spills on roads or concrete floors can be cleaned up with oil absorbent clay. At sea, oil floats on top of the water, forming an oil slick. Long flexible tubes called containment booms are filled with oil absorbent material, and placed around the oil slick to minimize its spread. Special ships, called skimmers, were developed in the 1990s to skim oil from the surface of the water. Before skimmers, detergents were used to 'sink' or disperse the oil.

Birds Killed in an Oil Spill

Volunteers Cleaning an Oil Spill Affected Area



Curious Fact

Dressing Up

Nylon, polyester, and lycra are all synthetic fibres that are created by linking up molecules of hydrocarbons. Each of these fibres has its own special quality. For example, acrylic dries faster than natural wool, because its fibres are smooth, with no rough edges to which drops of water can cling.

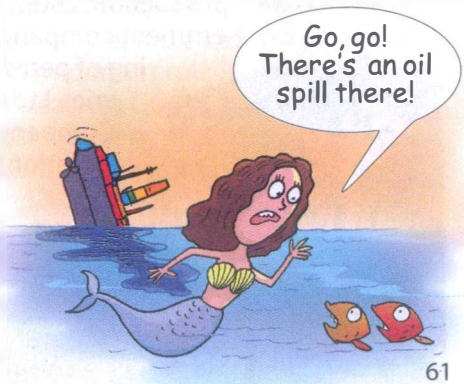
Why do oil spills damage the environment?

Oil spills can cause both immediate, and long-term environmental damage. When an oil slick from a large oil spill reaches the beach, the oil coats, and clings to every rock and grain of sand. Fibrous plants and grasses absorb the oil. This damages the plants, and makes the whole area unsuitable for wildlife.

Any oil spill in the ocean is a death sentence for sea birds. Coating the feathers with oil not only makes it impossible for birds to fly, but also destroys their natural waterproofing and insulation, leaving them vulnerable to hypothermia or overheating. Oil spills damage nesting grounds. Heavily furred marine mammals are affected in similar ways. Oil can also blind an animal, leaving it defenceless. Animals can be poisoned, and may die from oil entering the lungs or liver.

Oil spills often take a deadly toll on fish, shellfish, and other marine life, particularly if large numbers of fish eggs or larvae are exposed to the oil. There is no doubt about it- an oil spill is bad news for the environment.

An Oil Spill Affected Area



Petroleum in India

HPCL Petrochemical Complex at Visakhapatnam

ONGC Logo

Why is 1867 significant in the history of the oil industry in India?

It was in 1867 that oil was first struck in India at Makum in Assam. When India became independent in 1947, India's domestic oil production was just 250,000 tons per annum, and all the oil came from Assam. The industry was completely controlled by international companies.

In 1954, the government of India announced that petroleum would be a core sector industry and the government-owned national oil companies ONGC, IOC, and OIL were formed. These companies were engaged in oil exploration and production. Later, Indian Refineries Ltd, a government company was set up, and for marketing of petroleum products. Indian Refineries Ltd was merged with Indian Oil Company Ltd. to form Indian Oil Corporation Ltd in 1964.

An ONGC Platform at Mumbai High

Feeling Better

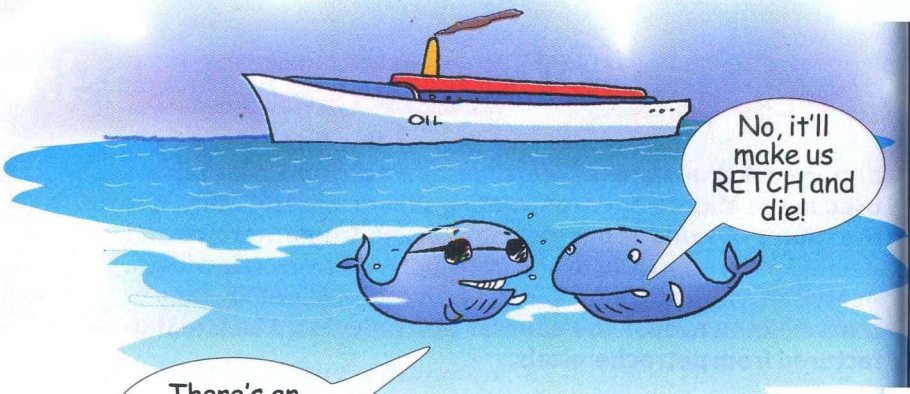
One of the first uses of oil, dating back thousands of years, was as medicine. Crude oil was used in the Middle Ages for treating skin diseases. Today, it is the source of some of our most important drugs. Steroids and painkillers are both hydrocarbons derived from petroleum. Acetylsalicylic acid, or ASA, is the active ingredient in many of the well-known, over-the-counter pain relievers. ASA is manufactured from petrochemicals.

What do you know about the growth of the oil industry in India?

The Indian oil and gas sector is one of the six core industries in India. During the 1960's, a number of oil and gas bearing structures were discovered by ONGC in Assam and Gujarat. In 1974, oil was discovered in significant quantities in Bombay High. Oil and natural gas was also discovered in the Tapti, Krishna-Godavari-Cauvery basins, Assam, Nagaland, and Tripura.

Reliance Petroleum Refinery-Jamnagar

In 1984, Gas Authority of India Ltd -GAIL- was set up. GAIL played an important role in the laying of a gas pipeline from Hazira in Gujarat to Jagdishpur in Uttar Pradesh. After independence, three coastal refineries were established. These included refineries by Burma Shell, and Esso Stanvac at Mumbai, and by Caltex at Visakhapatnam. Today, there are a total of nineteen refineries in India. Seventeen are in the public sector, and two are in the private sector, which are owned by Reliance and Essar.



Why did India start importing oil?

By the end of 1980's, there was a steady increase in the consumption of oil. India's production had been fairly consistent, but with increased consumption, domestic oil production was unable to meet the requirement. By 1990's, the government had no money for the development of some of the then newly discovered oil fields, and so started importing oil to meet the nation's needs. Starting in 1996, India's imports exceeded its production.Today, India is investing heavily in oil fields abroad. India's state-owned oil firms already have stakes in oil fields in Russia, Sudan, Iraq, Libya, Egypt, Qatar, Ivory Coast, Vietnam and Myanmar. The country's total oil consumption is about 2.2 million barrels per day. Now, India imports about 70 percent of its total crude oil consumption.

Curious Fact

Going Green

In recent years, oil companies have become more aware of the dangers caused by oil spills. They have started going green and investing in alternative forms of energy.

Sagar Samrat

Star Fact

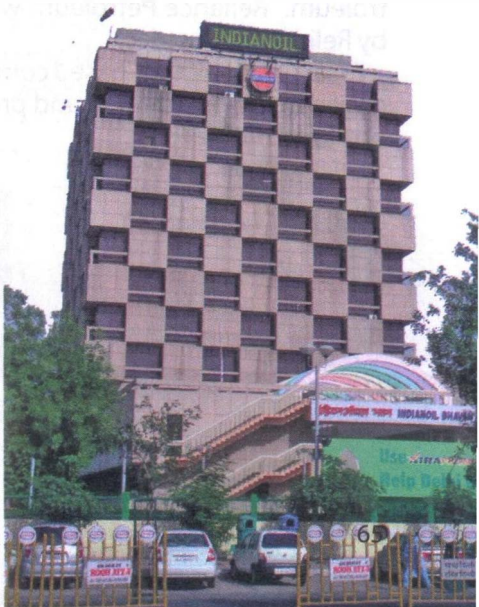
The Sagar Samrat is the mobile offshore drilling unit of the Oil and Natural Gas Corporation(ONGC) of India. ONGC started drilling in Bombay High (Mumbai High) with this drilling unit in 1973. Lying 160 kilometres off the coast of Mumbai, it is the main offshore oilfield of India.

Why are the IOC and ONGC considered the major petroleum companies in India?

The Indian Oil Corporation or IOC, and The Oil and Natural Gas Corporation or ONGC, are both state owned. The IOC is a corporation with its headquarters in New Delhi. It is the world's 98th largest public corporation, and the largest public corporation in India when ranked by revenue. The IOC group of companies owns and operates 10 of India's 21 refineries, with a combined refining capacity of 65.7 million metric tons per year. It operates the largest network of fuel stations. It also supplies Indane cooking gas to over 62.4 million households.

ONGC has its headquarters in Dehra Dun. It is one of the largest Asia-based oil and gas exploration and production companies. ONGC produces around 77 percent of India's crude oil and around 81 percent of its natural gas. It is involved in the oil exploration of 26 sedimentary basins of India. ONGC owns and operates over 11,000 kilometres of pipelines in the country.

Indian Oil Bhavan-New Delhi



Which are India's other major oil companies?

Bharat Petroleum, Hindustan Petroleum, Reliance Petroleum, and GAIL are the other major oil companies in India, besides ONGC and IOC. Bharat Petroleum is an Indian state-controlled company.

Hindustan Petroleum Corporation Ltd, also called HPCL, has steadily grown over the years. The HPCL operates two major refineries. GAIL is a gas utility company in India.

The Burma Oil Company, was an important player in the South Asia, in the 1860's. In 1928, the Asiatic Petroleum Company in India started cooperation with the Burma Oil Company. This alliance led to the formation of Burmah-Shell Oil Company. Later, it was taken over by the Government of India and became the Bharat Petroleum. Reliance Petroleum was set up by Reliance Industries.

Essar Oil is an India-based company engaged in the exploration and production of oil and natural gas.

Oil Rig at Mumbai High

Oil Countries and OPEC

Which country has the largest reserves of oil today?

Annual report of British Petroleum says that Venezuela has overtaken Saudi Arabia to become the world's largest holder of proven oil reserves. The South American country's deposits stood at 296.5 billion barrels at the end of last year, while Saudi Arabia held 265.4 billion barrels. Saudi Arabia now trails Venezuela(18%), with a 16 percent share of world proven oil reserves, according to a report. Canada ranks third with 175.2 billion barrels, or 11 percent of the total reserves. Russia boosted its deposits to 88.2 billion barrels from a revised 86.6 billion a year earlier. Reserves in Norway also increased last year. The country's deposits rose to 6.9 billion barrels.

Flag of Venezuela

Star Fact

Oil Coup!

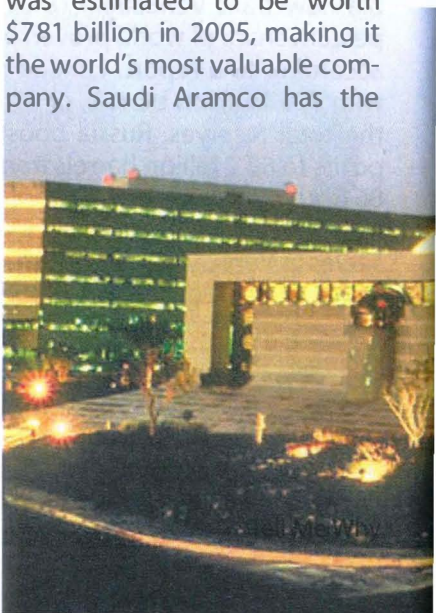
Mohammed Mossadegh was the democratically elected prime minister of Iran from 1951 to 1953. He was removed from power in a coup when he nationalized the assets of the British controlled Anglo Iranian Oil Company. The coup was supported by Britain and the US.

Mohammed Mossadegh

Flag of Saudi Arabia

Why is the Saudi Arabian Oil Company so famous?

The national oil company of Saudi Arabia is Saudi Aramco, or the Saudi Arabian Oil Company. Since its beginning in 1933, Saudi Aramco has enjoyed 75 years of impressive growth – and is set to continue growing, well into the future. It was estimated to be worth $781 billion in 2005, making it the world's most valuable company. Saudi Aramco has the



Curious Fact

Military in Oil Field

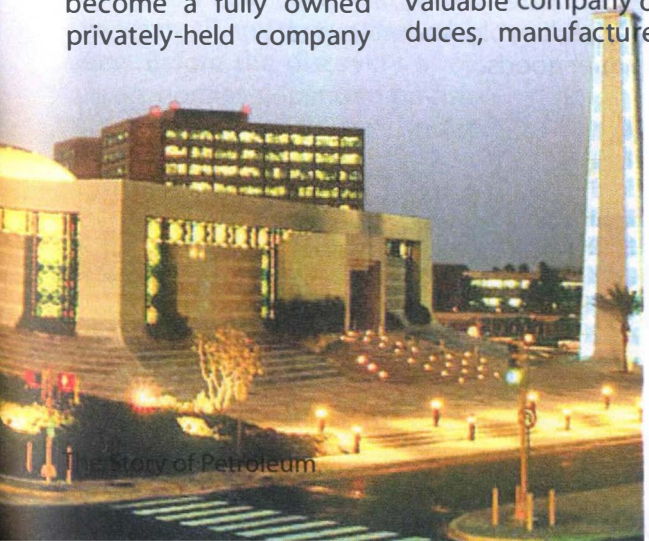
The United States keeps planes and troops in The Middle East to ensure that there is no disruption in the oil that Saudi Aramco supplies to the world, for that would wreack havoc on the global economy. However, US military bases are a cause of much tension in the region.

largest proven crude oil reserves in the world- it also has the largest daily production of oil in the world.

Saudi Aramco manages over 100 oil and gas fields in Saudi Arabia. It owns the world's largest oil fields, the Ghawar Field, and the Shaybah Field. Today, Saudi Aramco has become a fully owned privately-held company with no shareholders or partners in business. To sum up, Saudi Aramco is the world's largest, richest, and most valuable company of all time. It produces, manufactures, markets, and ships crude oil, natural gas and petroleum products to meet the global demand. Is it any wonder then, that it is so famous?

ارامكو السعودية
Saudi Aramco

Logo of Saudi Aramco Oil Company

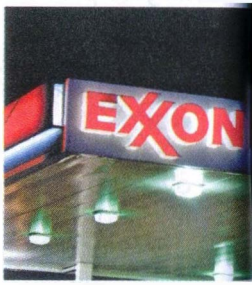


Saudi Aramco Headquarters

Corporate Headquarters of Exxon Mobil Corporation

What do we know about the Exxon Mobil Corporation?

The Exxon Mobil Corporation is the parent of the Esso, Mobil, and Exxon Mobil companies around the world. It is an American multinational oil corporation, which was formed in November 1999, by the merger of Exxon and Mobil. Exxon Mobil has 37 oil refineries in 21 countries, constituting a combined daily refining capacity of 6.3 million barrels. It is the largest refiner in the world, and the largest of the six oil super majors. Over the last 125 years, Exxon Mobil has evolved from a regional marketer of kerosene in the US, to the largest publicly traded petroleum and petrochemical enterprise in the world. Exxon Mobil products drive modern transportation, power cities, lubricate industry, and provide petrochemical building blocks that lead to thousands of consumer goods.



An Offshore Oil Platform of Exxon Mobil Corporation

Abu Dhabi-Capital of UAE

Why is oil important to Arab states?

The Arab states are Saudi Arabia, United Arab Emirates, Qatar, Kuwait, Bahrain, and Oman. They border the Persian Gulf, and are part of the Gulf Cooperation Council. Their populations are small, and the land is mainly barren. Before the discovery of oil, their economies depended on fishing, pearl diving and the pearl industry.

However, the pearling industry collapsed in the 1930s after the development of cultured pearl methods by Japanese scientists. Without oil, the Arab states were poor countries. It was oil that brought a boom to these nations, and made some of them, very rich.

Flag of UAE

What is OPEC?

OPEC stands for the Organization of Petroleum Exporting Countries. It is made up of countries that have come together for the purpose of negotiating with oil companies on matters of petroleum production, prices, and future concession rights.

OPEC was created at the Baghdad Conference in September 1960, by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. They were the five founding members who were later joined by nine other countries. Two of them were suspended later, and now, OPEC has only twelve members. OPEC's purpose is to protect the interests of oil-producing countries, and they unite in policy to protect their common interests. Its decisions have a large influence on the world price of oil. OPEC tries to control the world oil price through setting quotas for its members, which are raised when the oil price is high, and lowered when it is low. Practically speaking, OPEC wields a powerful weapon in that it dominates the crude oil market, and can virtually

OPEC Logo

OPEC Headquarters

ALGERIA

ANGOLA

ECUADOR

IRAQ

IRAN

QATAR

KUWAIT

LIBYA

NIGERIA

SAUDI ARABIA

UAE

VENEZUELA

OPEC MEMBERS

OPEC is the united front of 12 oil producing countries. They are Iran, Iraq, Kuwait, Qatar, Saudi Arabia, Algeria, Nigeria, Angola, Venezuela, Ecuador, the United Arab Emirates and Libya. The five original members, or founding states were the Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela.

dictate crude oil prices. Throughout its history, OPEC has also imposed crude oil embargos, targeting countries whose policies they disapprove of.

Do you know the meaning of embargo? An embargo is a policy, usually put in place by a government or organization, which stops the flow of goods, services or information to another government, or organization. OPEC-imposed crude oil embargos have both short term and long term effects. In the short term, crude oil prices skyrocket, leading to inflation and economic recession. In the long-term, oil-dependent countries are typically forced to reach some agreement with OPEC to remove the embargo, often compromising on policies.

OFID Headquarters

What is OFID?

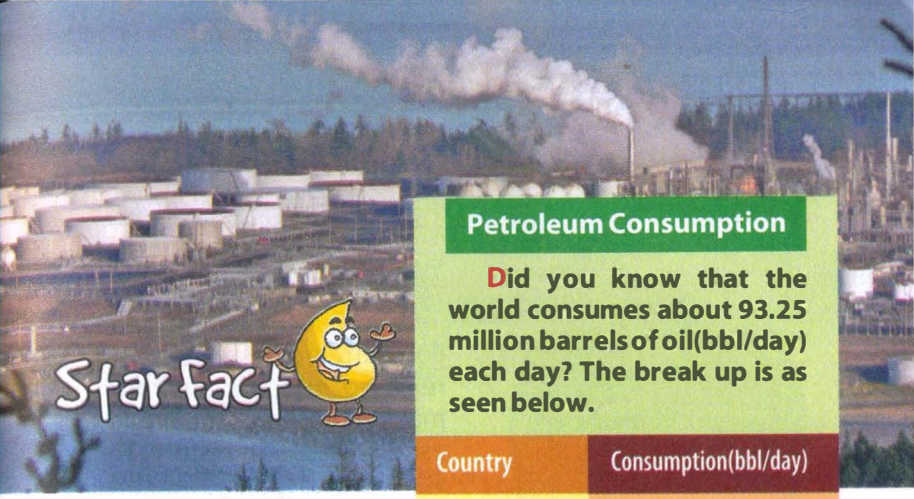
OFID, 'The OPEC Fund for International Development', was intended to be a temporary facility. It was created as an international fund that was collectively owned by the countries contributing to it. In May 1980, the 'OPEC Fund' became a fully-fledged, permanent international development agency known as OFID. OFID is today a multilateral development finance institution which seeks to promote cooperation between member states of the OPEC, and other developing countries. It was established in January 1976.

OFID presently has 12 member countries. They are Algeria, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. The bulk of OFID's assistance has been directed to those countries which are least developed, and most in need of financial support.

OFID Logo

What is meant by peak oil?

Oil is a finite, non-renewable resource-one that has powered economic and population growth over the last century and a half. The rate of oil 'production', which refers to extraction and refining, is currently about 87 mil-



Petroleum Consumption

Did you know that the world consumes about 93.25 million barrels of oil(bbl/day) each day? The break up is as seen below.

Country	Consumption(bbl/day)
United States	19,150,000
China	9,400,000
Japan	4,452,000
India	3,182,000
Saudi Arabia	2,643,000
Germany	2,495,000
Canada	2,209,000
Russia	2,199,000
Korea, South	2,195,000
Mexico	2,073,000
Brazil	2,029,000
France	1,861,000
Iran	1,845,000
U K	1,622,000
Italy	1,528,000

Source : **CIA World Fact Book**

lion barrels per day. It has grown almost every year of the last century. Once we have used up about half of the original reserves, oil production is likely to stop growing, and begin declining. Hence, the term 'peak oil' refers to the point in time, when the maximum rate of petroleum extraction is reached, after which the rate of production is expected to enter terminal decline. The peak in oil production does not signify 'running out of oil', but it does mean that oil will become even more and more expensive. Optimistic estimations of peak production forecast the global decline will begin after 2020.

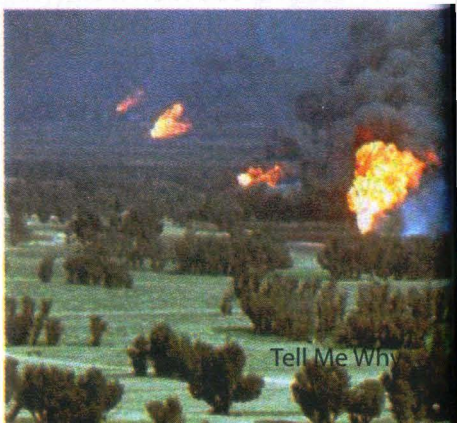
Petroleum Jelly

Petroleum jelly is a semi-solid mixture of hydrocarbons. It is promoted as a topical ointment for its healing properties. It is no longer considered as a 'cure all' medicine, because of a scientific understanding of appropriate and inappropriate uses. However, it is an approved skin protectant, and remains widely used in cosmetic skin care.

● *Arvind Bhat*

Why is the Gulf War associated with oil spills?

In January and February of 1991, Iraqi military forces deliberately set fire to oil wells in Kuwait, and released oil into the Persian Gulf. As many as one billion barrels of oil were burned or released into the environment, making these acts the single largest oil disaster in history. To prevent further spillage into the Persian Gulf, American fighter bombers destroyed pipelines. The oil spill had disastrous consequences for the area around Kuwait and Iraq. The desert is normally covered with a protective layer of pebbles that prevents sand from being blown about and formed into dunes by the wind. In many places, however, oil sprayed from exploded wells soaked into the desert surface and hardened, combining with



US Aircrafts Flying over the Burning Oil Wells in Kuwait

the pebbles to form a new, hard as rock substance. All vegetation in these spots was permanently destroyed.

The oil well fire smoke rose to altitudes of one to four kilometres. The plume of smoke was dense enough to block out most sunlight when it was overhead. Marine and wild life was severely affected. The Kuwait fishing industry, and Saudi shrimp production were wiped out. Almost 30,000 pelagic species and as many as 250,000 water birds were killed.

Curious Fact

Storage Trade

Sometimes, oil tank owners and companies buy oil and hold it in storage for customers for future delivery at a higher price. When delivery dates approach, they close out existing contracts and sell new ones for future delivery of the same oil at even higher prices. The oil never leaves storage, and this is known as oil storage trade. It has been estimated that one in twelve of the largest oil tankers are being used for the storage, rather than transportation of oil.

An Oil Field on Fire during the Gulf War of 1991

World Oil Production

Saudi Arabia leads the world in oil production. Russia is in the second position. The actual figures are as follow:

Country	Production (bbl/day)
Saudi Arabia	10,520,000
Russia	10,270,000
United States	9,688,000
Iran	4,252,000
China	4,073,000
Canada	3,483,000
Mexico	2,983,000
United Arab Emirates	2,813,000
Iraq	2,642,000
Nigeria	2,458,000
Kuwait	2,450,000
Venezuela	2,375,000
Brazil	2,301,000
Norway	2,134,000
Algeria	2,078,000

Source : CIA World Fact Book

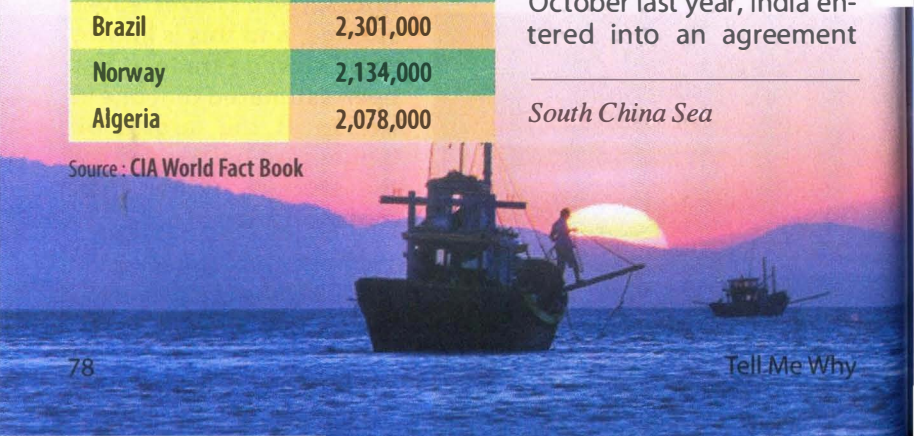
Which are the worst oil spills in history?

Oil spills can kill wildlife, pollute the air and water, and alter the ecosystem for years to come. Some of the worst oil spills in history have occurred at sea. In 1976, the tanker Argo Merchant ran aground on Fishing Rip and broke apart a few days later, spilling its en-

Why is oil exploration in South China Sea controversial?

The state-owned ONGC-Videsh will go ahead with the exploration of oil in the South China Sea. ONGC-Videsh is an arm of the ONGC created to prospect for oil and gas abroad In October last year, India entered into an agreement

South China Sea

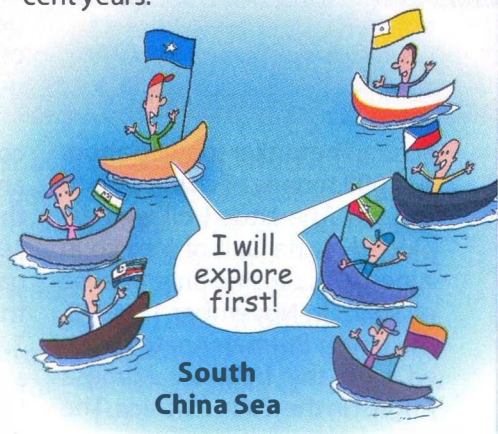


Argo Merchant Tanker

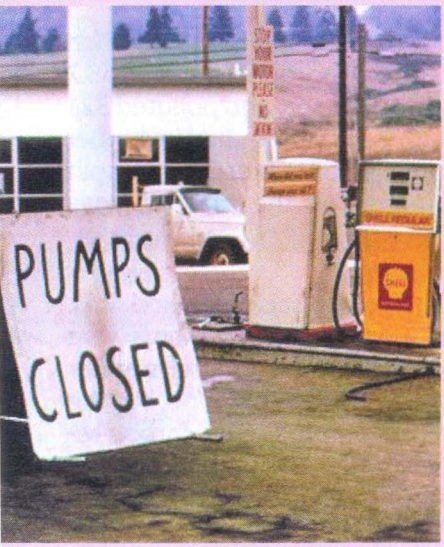
tire cargo of 7.7 million gallons of oil. In 1978, when the tanker Amoco Cadiz ran aground, it spilled 68.7 million gallons of oil into the sea, and polluted 321 kilometres of Brittany's coastline. In November 1988, the American-owned oil tanker Odyssey split into two 1128 kilometres off the coast of Nova

with Vietnam to expand and promote oil exploration in the South China Sea. The South China Sea is estimated to have 23 billion tonnes to 30 billion tonnes of oil, and 16 trillion cubic metres of natural gas. It has the potential to become the world's fourth-largest deep-water drilling region, after the so-called 'Golden Triangle' of the Gulf of Mexico, Brazil, and West Africa.

The South China Sea is the most disputed maritime region in the world. Six different countries have been arguing about ownership of these waters for decades, often citing centuries-old precedents to back up their claims. For a long time, the claimants were happy to let the quarrel simmer quietly in the background, but the promise of huge hydrocarbon reserves under the seabed has significantly raised the stakes in recent years.



Oil Crisis



Oil Crisis-A Scene from 1974

Why is oil a reason for conflict?

Oil is so essential for every aspect of life today that countries do not hesitate to go to war over oil. Oil provides the energy to fuel everything from a nation's transport network, to its industries. Oil is especially vital to ground, air, and sea transportation, providing approximately 95 percent of all energy used for this purpose. In addition, petroleum is the basic component - or 'feedstock'- for most plastics, pesticides, paints, solvents, and other vital products. Conflict over the control of valuable oil supplies has been a persistent feature of in-

Scotia. The tanker spewed about 132,000 tonnes of crude oil into the sea. The Ixtoc I oil well exploded in the Gulf of Mexico in June 1979, causing an immense oil spill. On November 1st, 1979, the tanker Burmah Agate collided with the freighter Mimosa August in the Gulf of Mexico. The collision caused an explosion and a fire on the Burmah Agate, that burned until January 8th, 1980. An estimated 2.6 million gallons of oil were released into the environment, and another 7.8 million gallons were consumed by the fire. When the Exxon Valdez ran aground on

Oil Crisis in US - 1979

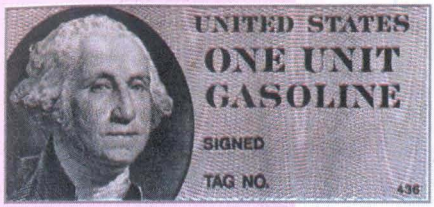
ternational affairs since the beginning of the 20th century. The enormous oil reserves of Middle Eastern countries have often been a cause of conflict between other nations of the world.

Why was there an oil crisis in the 1970's?

Oil plays such a critical role in fueling the world economy that any prolonged shortage in its availability can produce a global economic recession. In the 1970's, the major industrial countries of the world faced shortages in petroleum. There were a series of energy crises between 1967 and 1979, caused by problems in the Middle East, but the most significant crisis started in 1973 when Arab oil producers imposed an embargo. They decided to boycott America, and punish the west in response to support for Israel in the Yom Kippur War against Egypt. This led to the price of crude rising from $3 per barrel to $12 by 1974. The price of petrol rocketed, making all transport more

March 24th, 1989, off the coast of Alaska, it spilled 10.8 million gallons of oil along 1100 miles of Alaskan coast. The spill could have been much worse - the Valdez was carrying 53 million gallons.

The worst oil spill in history happened during the Gulf War after Iraqi forces opened valves of oil wells and pipelines as they retreated from Kuwait in 1991. The Fergana Valley, one of Central Asia's most densely populated agricultural and industrial areas, was the site of the largest inland oil spills in history in 1992.



A Gas Coupon Printed During the 1979 Oil Crisis

expensive. At the same time, US oil consumption was high in the early 1970's, while U.S. oil production declined. To sum up, the energy crisis of the 1970's was rooted in the world's increasing dependence on oil from the Middle East, and the OPEC's 1973 decision to halt oil shipments to countries supporting Israel in the ongoing Yom Kippur War.

What caused the oil crisis of 1979?

The 1979 energy crisis started when the Shah of Iran, Mohammad Reza Pahlavi, fled the country amidst protests. These protests severely disrupted the oil industry in Iran, leading to decreased production, and the suspension of exports. Ayatollah Khomeini was soon installed as the new leader of the country, but oil still flowed slowly out of the country, leading to a continued increase in prices. In 1980, Iraq attacked Iran, leading to a further slowdown in oil production from both Iraq and Iran. All of these events led to a disruption of net oil exports, which resulted in the price of oil soaring.

bp

British Petroleum

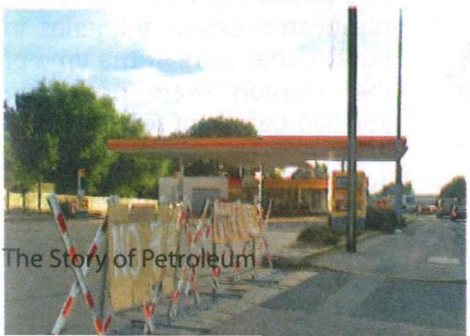
Anglo Persian Oil Company was the first big company to use oil from the Middle East, and the oil that it supplied was vital to Britain during World War I. Britain's oil powered battle ships had the edge over Germany's coal powered ships. This Company later became British Petroleum (BP).

● *Sneha Rao*

How did the oil crisis of 1973 affect the world?

The oil crisis of 1973 began on October 17th when Arab members of the Organization of Petroleum Exporting Countries, in the midst of the Yom Kippur War, announced that they would no longer ship petroleum to nations that had supported Israel in its conflict with Egypt–that is, to the United States and its allies in Western Europe. At around the same time, OPEC-member states agreed to quadruple world oil prices.

As a result, a crisis developed because of the complete dependence of the industrialized world on oil, much of which resided beneath the surface of Middle Eastern countries. The increase in the price of oil had a dramatic effect on oil exporting nations. The countries of the Middle East had long been dominated by the industrial powers. They now had control of a vital commodity, and became immensely rich. At the same time, the shock created havoc to the economies of the developed countries of the west.

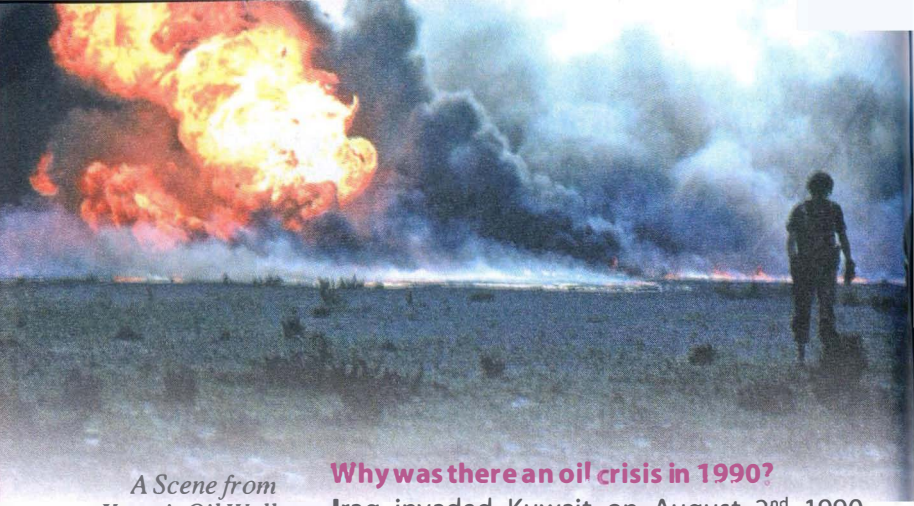


Curious Fact

Fuel Protests

A series of campaigns were held after 2000 in the United Kingdom over the cost of petrol and diesel for road vehicle use. The first protest in 2000 was primarily led by lorry drivers and farmers. The aim of the protests was to secure a reduction in the fuel duty rate on petrol and diesel, but the government did not co-operate. In 2007, fuel protests were held, but were not widely supported, nor did they cause much disruption.

● *Radha Nair*



A Scene from Kuwait Oil Well Fire

Why was there an oil crisis in 1990?

Iraq invaded Kuwait on August 2nd 1990. Saddam Hussein of Iraq charged that Kuwait and the United Arab Emirates had exceeded their OPEC quotas, which resulted in the price of oil being kept low. He claimed that overproduction was encouraged by the United States, in order to weaken Iraq. The invasion of Kuwait resulted in the Gulf War of 1990.

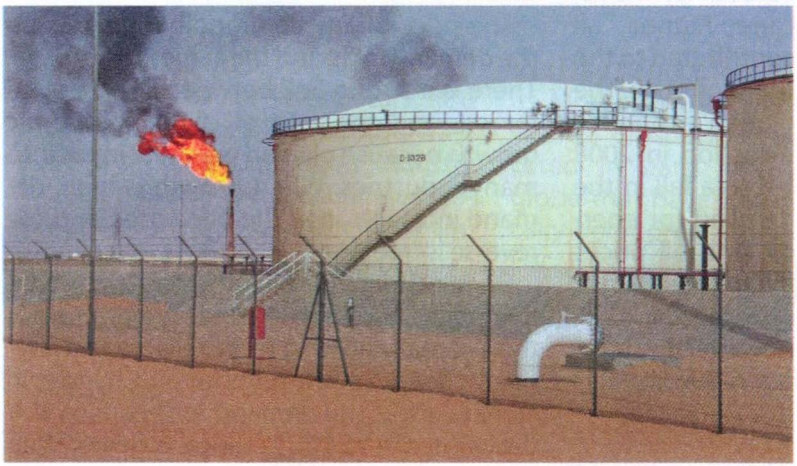
On August 6th, the United Nations imposed an immediate, and nearly total embargo on oil exports from Iraq, as well as on Kuwait, which Iraq had, by then, absorbed. This embargo removed almost 5 million barrels a day of oil from the world market. However, the embargo also forced the shutdown of sophisticated export refineries in Kuwait, that were at the time of the invasion, were producing 750,000 barrels of refined product per day, The Gulf crisis, including the war, had enormous consequences for the region.

Curious Fact

No Stock!

The US government predicts that oil production will go on rising until 2030. Some experts believe, however, that it will peak in the next few years, or may even have peaked already. Production in some oil fields is already declining. To maintain current production, we must find other big reserves, or use new existing sources like oil sands.

● *Dev Nath*



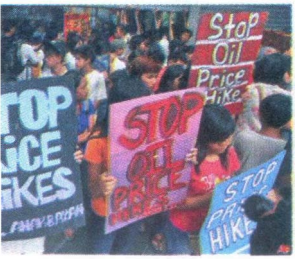
A Huge Oil Storage Tank

What caused the energy crisis between 2003 and 2008?

During 2003, the price of oil rose, and it continued to rise till it peaked in 2008. There were many reasons given for this rise. These included a decline in petroleum reserves, worries that oil reserves had peaked, Middle East tension, and oil price speculation. Political events and natural disasters indirectly related to the global oil market had

strong short-term effects on oil prices too. The North Korean missile tests, the 2006 conflict between Israel and Lebanon, worries over Iranian nuclear plants in 2006, and the devastation caused by Hurricane Katrina all contributed to the rise in oil price. The global economic recession in 2008 led to a fall in the demand for energy, and oil prices fell to their lowest in December 2008. However, by October 2009, oil prices had stabilized.

A Protest against Oil Price Hike



Why does the price of oil keep changing?

The price of any commodity depends on the demand for it, and the same is true for oil. There is a strong link between the demand for oil, and the rate of global economic growth because oil is an essential input into many industries. When growth is high, demand increases, and the price rises, and the reverse is true too.

Demand for crude oil is affected by the relative prices of oil substitutes, and right now, there is really no long term, reliable and relatively cheaper substitutes for oil. Changes in climate affect the demand for heating oil. If the winter in North America is fierce, then

Fuel from Waste

Waste is dumped in huge quantities in areas known as landfills. As this waste decomposes, it releases methane gas, which could be used as fuel, if only we could find a way to collect the gas from these landfills.

Bio Bus!

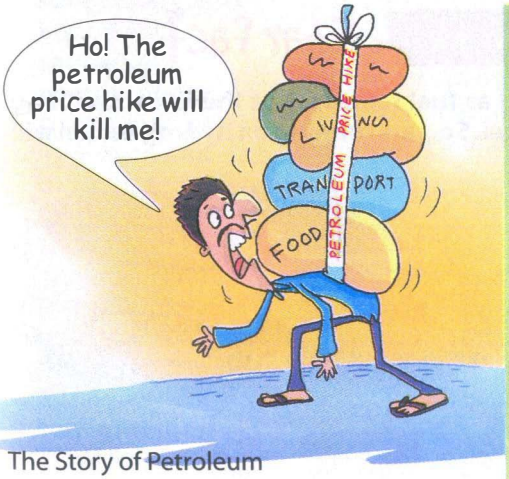
Vegetable oil can be converted into a fuel called biodiesel which can run diesel engine vehicles, if it is mixed with conventional diesel. Work is being done to develop and promote the use of simple home units that carry out such conversion.

Curious Fact

A Bus Run By Biodiesel

the price of oil rises. The high level of demand for oil by speculators also pushes up oil prices. People are always buying, or selling oil. Many industry experts think all the speculative trading in oil is resulting in too many unpredictable oil price fluctuations.

The price of oil also depends on its supply. OPEC production cuts generally lead to price increases. Moreover, a lot of the world's oil supply is located in parts of the globe that have historically been prone to political instability-and this leads to instability in oil prices as well.



Vegetable Fuel

Did you know that a car engine can be run on vegetable oil? However, to get enough vegetable oil, huge amounts of land would have to be cultivated to grow this fuel - and right now, that just isn't practical.

A Supermarket

How does the petroleum price hike affect the common man?

Petrol, diesel, kerosene and cooking gas all are part of our daily life, and they are all derived from petroleum. So, any increase in the price of petroleum affects the common man in many ways. An increase in the price of diesel results in an increase in transportation charges, which leads to the price of almost all commodities going up. A hike in diesel price directly increases the cost of production of the farmers, as diesel is used in almost all agricultural activities from irrigation to transportation. Food prices rise when cooking gas and kerosene, which is used for cooking, become more expensive. Public transport costs more, and the increase in petrol charges raises the fuel charges of personal vehicles, burdening the middle classes even further. Thus, a rise in petroleum prices affects every level of society- but there is no doubt that the poor and the middle class suffer the most.

Hydrogen Cars

Star Fact

Hydrogen can be used as fuel for cars, but there are no filling stations to supply this fuel. So, cars running on hydrogen fuel will have to extract the hydrogen from conventional fuel. Daimler-Chysler's Necar 5 uses methanol- which can be supplied at filling stations- as its hydrogen source.

Petroleum Alternatives

An Electric Motor Cycle

How can we reduce oil usage?

It is important to reduce the consumption of petroleum products. There is also another urgent reason to cut down on the use of fossil fuels like petroleum. The burning of oil and other fossil fuels is making the world's climate warmer-and most experts are convinced that we face ecological disaster if we do not find ways to use less oil soon.

We can cut down on the use of petrol and diesel by opting for public transport rather than personal vehicles like cars and scooters. Or even better, use a cycle, or walk whenever you can. Go to nearby shops to save on petrol, and be very careful about the consumption of energy at home. Turn off lights and fans when not in use, and use electrical appliances sparingly and carefully. If we all do our bit, we can surely cut down on oil consumption-and this will be good both for our wallets-and for our planet.

Water and Sunlight

Water and sunlight are also important sources of energy. Water can be split into hydrogen and oxygen, and the hydrogen used to power cars. The water is split using sunlight, so in future, cars may run on water and sunlight!

A Fuel Filling Station in Brazil

Why is it time to find substitutes for oil?

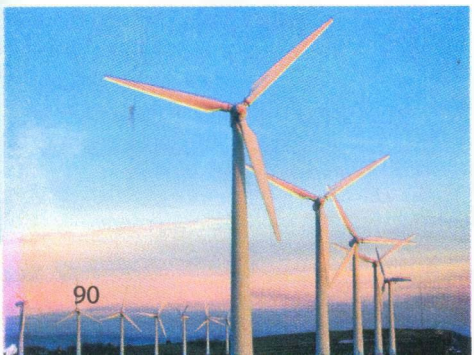
We must find substitutes for oil as the world's oil supplies are dwindling, and the burning of oil is causing global warming, which in turn, is disastrous for our planet. Nearly all the major motor manufacturers are now developing 'green' cars that use alternatives to oil. Some use alternate bio-fuels like ethanol; others are powered by batteries or solar cells. Organic waste can also be converted into methane for cooking and lighting purposes in place of kerosene and cooking gas.

Bio-fuels are made from plants by converting their sugar and starch into fuels like ethanol. They have the advantage of being renewable, since plants can be grown to replace those that have been used in the manufacture of bio-fuels.

How can we use wind as an alternative to oil power?

Our ancestors have harnessed the power of the wind to sail boats and drive windmills. Today, wind is used to drive wind turbines that generate electricity. Windmills work because they slow down the speed of the wind. The wind flows over the blades, causing a lift that makes them turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.

A Wind Farm



Today's wind machines are much more technologically

A Wind Farm in Tamil Nadu

advanced than those early windmills. They are made up of two or three propeller-like blades, called the rotor. The rotor is attached to the top of a tall tower. When the wind blows, it spins the rotor. As the rotor spins, the energy of the movement of the propellers gives power to a generator. There are some magnets and a lot of copper wire inside the generator that generate electricity.

Have you seen a wind farm? Wind farms are places where many wind turbines are clustered together. They are built in places where it is nearly always windy. Wind energy is pollution free, and renewable. Using wind energy means that less of coal and oil needs to be burned to make electricity. Just one wind turbine can generate enough electricity for a single house, or the electrical energy to pump water, or to power a mill which grinds grain. The electrical energy can also be stored in batteries.

Wind Pump

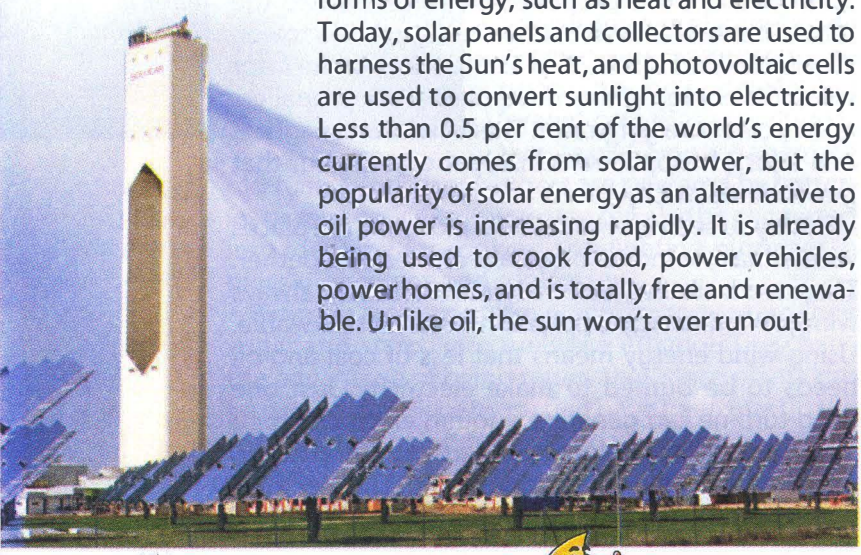
Netherlands is famous for its windmills, which are actually pumps for draining water from low lying areas. In North America too, farms had wind mills that were actually pumps. These windmills usually had a wheel with many small, angled blades.

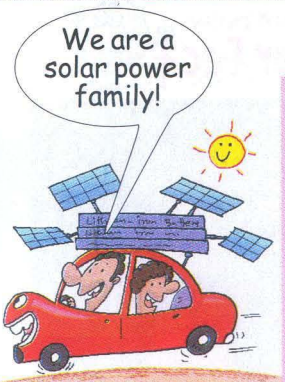
Star Fact

How can solar energy be used instead of oil?

A Solar Power Plant in Spain

The sun is a powerful source of energy. In fact, the sunlight that shines on the Earth in just one hour could meet the world's energy demand for an entire year! Solar energy can be converted directly, or indirectly into other forms of energy, such as heat and electricity. Today, solar panels and collectors are used to harness the Sun's heat, and photovoltaic cells are used to convert sunlight into electricity. Less than 0.5 per cent of the world's energy currently comes from solar power, but the popularity of solar energy as an alternative to oil power is increasing rapidly. It is already being used to cook food, power vehicles, power homes, and is totally free and renewable. Unlike oil, the sun won't ever run out!





Star Fact

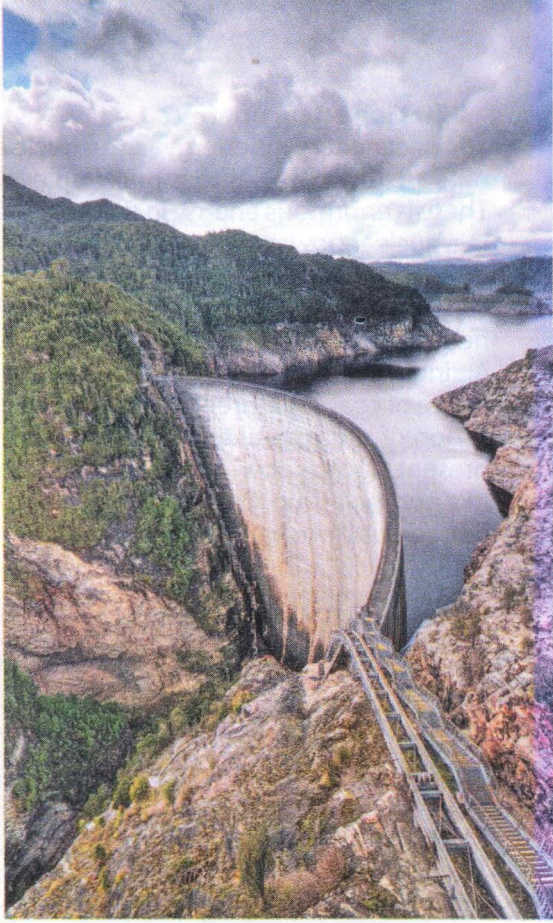
Solar Power Station

A Solar power station has hundreds of flat mirrors that direct sunlight at a central receiver mounted on a tower. In theory, a solar power station of 260 sq km in a sunny place could generate all the electricity needed to supply an area equal to the area of the entire USA.

Why is water an established form of energy?

For thousands of years, the power of running water has been used in water wheels to grind corn and wheat, as well as to run simple machines. Today, water power is used mainly to produce electricity. This is known as hydroelectric power. A dam is built where there is a natural lake or a big river in a valley. The dam is used to hold the water and create pressure so that the water can produce more electrical power.

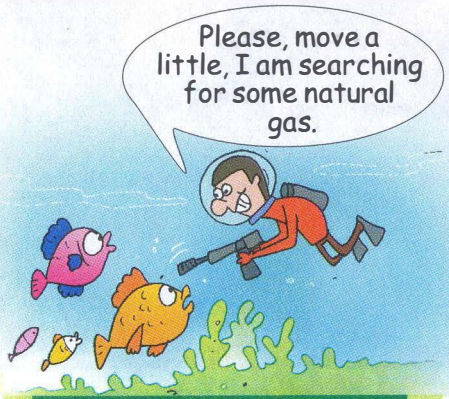
The water has immense pressure due to the great height at which it is kept in the dam. The water in the dam is released in a powerful flow that turns the generators which produce electricity. Hydroelectric power is very expensive to set up, and it is hard to find suitable sites. Once running, though, it is very clean and very cheap. Hydroelectric power is reliable and renewable, because the process takes nothing away from the environment, and therefore, nothing needs to be replenished. The water stays in the water cycle, and can keep producing energy endlessly.



The Gordon Dam in Tasmania

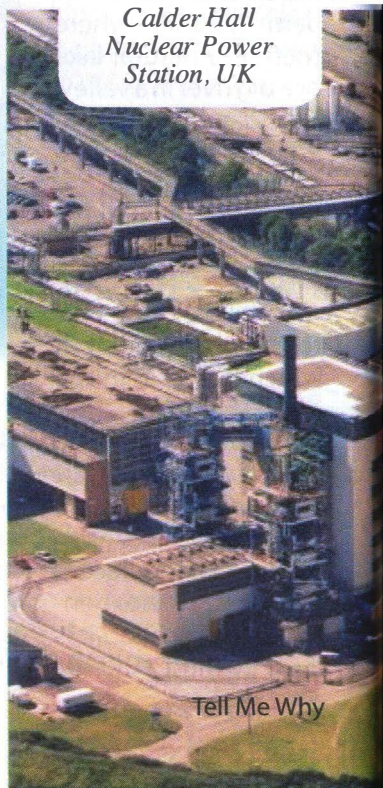
What is nuclear energy?

Nuclear energy is energy in the nucleus, or core of an atom. Atoms are tiny particles that make up every object in the universe. There is enormous energy in the bonds that hold atoms together. In a nuclear power station, nuclei are split apart to release this energy. This is called fission. The nuclei are split by firing tiny particles called neutrons at them. As the nuclei split, they release more neutrons, which in turn, split other nuclei, causing a chain reaction. A single 6 gm pellet of nuclear fuel yields as much energy as a tonne of coal, and three of these pellets, weighing less than a teaspoon of sugar, could meet a family's energy needs for a year. At present, nuclear power provides only 20% of the world's electricity. It is non-polluting, but it produces radioactive waste that can be dangerous if not handled properly.



Energy from Space

NASA is investigating the idea of giant sun-collecting discs that could be attached to satellites orbiting Earth. These discs could collect the streams of energy coming from the sun and beam this energy down to Earth in the form of microwaves.



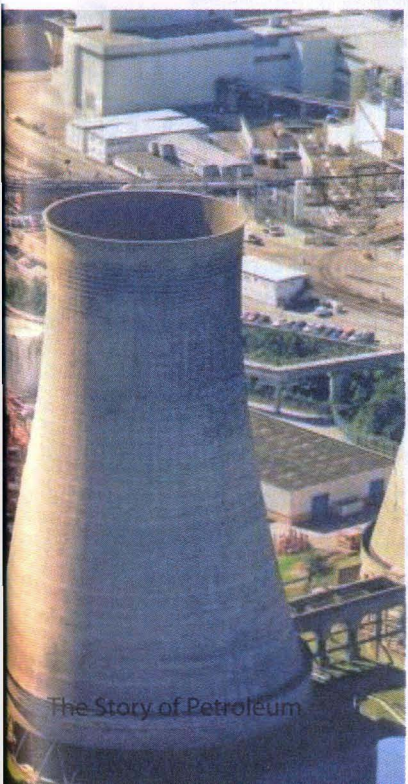
Calder Hall Nuclear Power Station, UK

Wildlife in Danger

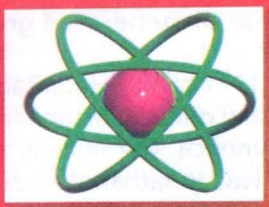
Bio-fuels are fuels derived from plants, and are non- polluting and renewable. But cultivating plants needs land, and where this land is acquired by cutting down forests, wildlife is threatened.

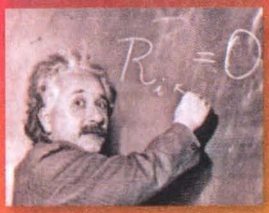
Why has oil generated great wealth?

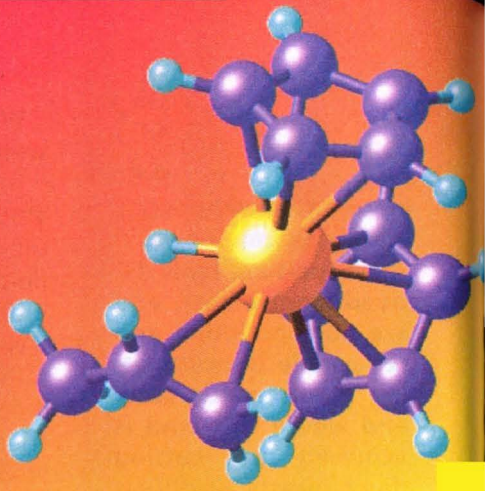
In the 19th century, Hadji Taghiyev in Baku made a fortune from oil. In America, the first oil millionaire was Jonathan Watson of Titusville. In the late 20th century, it was the Arab sheikhs who were famous for their oil wealth. Oil wealth has transformed countries along the Persian Gulf which were considered once poor, but now boast of booming, and gleaming modern cities like Dubai. After the breakeup of Soviet Union, shrewd Russian investors, such as Mikhail Khodorkovsky and Roman Abramovich, bought the state oil and gas companies that were being sold cheaply, and became billionaires.



Mikhail Khodorkovsky







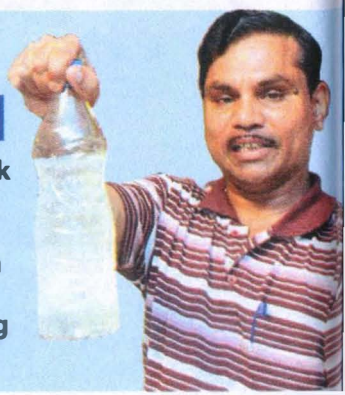
Next issue

THE STORY OF SCIENCE

Star fact

Ramar 'Petrol'!

In 1996, Ramar Pillai of Tamil Nadu took the nation by storm, claiming to turn water into petrol using a herbal formula, which he claimed was made from a miraculous bush. This raised a huge controversy, with many people praising him and many calling him a fraud.



Solar Cells

Solar powered cells could be used to fly planes and cars. The problem is that they need too much space, so research is being conducted on how to make them more efficient. NASA already has an experimental research aircraft named Helios, that is solar powered.

Why is the India- Iran pipeline project important?

The India Iran pipeline project is a 2700 km, pipeline that will transfer gas from Iran's South Pars fields in the Persian Gulf, to Pakistan's major cities of Karachi and Multan, and then further to Delhi, India. The cost of the project is an estimated US$ 7 billion.The total length of the 2700 km project would run 1100 kms in Iran, and 1000 kms to Pakistan and India. It will continue 600 km in Indian territory. This project is expected to greatly benefit India and Pakistan, which do not have sufficient natural gas to meet their rapidly increasing domestic demand for energy.

The Story of Petroleum

Clarifications & Corrections

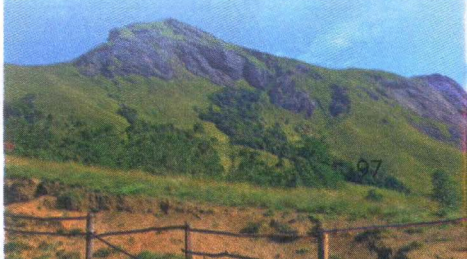
Mohammed Irfan A., a student of class 9, St. John's Senior Secondary School and Jr. College, Triplicane, Chennai has an add-on information to our July issue - Heritage Sites in India. He writes:

In sheer coincidence, at the time of reading of Manorama Tell Me Why (July issue), I read the news of the Western Ghats making it to the coveted list of World Heritage Sites.

Manorama Tell Me Why is my companion and I enjoyed reading about the Indian Heritage Sites, in detail.

Dear Irfan, thanks for the valuable information. As you said, The Western Ghats has been added to the list of World Heritage Sites by UNESCO. That too, on the release day of our issue, the 'Heritage Sites' in India!

- Editor



I Wonder Why?

Question of the Month

Send us your questions
E mail: **childrensdivision@mmp.in**

Why is LED TV different from LCD TV?

LED TV is an advanced form of LCD TV. Liquid crystal (LC) is a state of matter that has properties between a conventional liquid and a solid crystal. Liquid crystals do not emit light directly, but they can modulate light. An LCD consists primarily of two glass plates with some liquid crystal material between them. When an electrical pulse is applied, the liquid crystal particles are oriented in a crystal form. If we allow polarized light to pass through this, light is blocked at certain points and these points appears as dark spots. In an LCD TV, a light source having several fluorescent tubes is arranged behind the display screen to illuminate the picture.

LED stands for Light Emitting Diode. LED glows when a voltage is applied. The basic difference of LED TV from an LCD TV is that, it uses Light Emitting Diodes as light source instead of fluorescent tubes. The image is created by the LEDs glowing at varying intensities.

● *Alwin George*

MANORAMA TELL ME WHY - THE STORY OF PETROLEUM

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Printed and Published by V. Sajeev George, on behalf of M.M. Publications Ltd, P.B. No. 226, Kottayam - 686 001 at M.M. Publications Ltd, P.B. No. 226, Kottayam - 686 001 and Malayala Manorama Press, Kottayam - 686 039 and published from M.M. Publications Ltd, P.B. No. 226, Kottayam - 686 001.

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DIESEL PLANT !

Jatropha- Its seeds can be used to produce high-quality biodiesel.